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STEAMER W. G. POLLOCK.

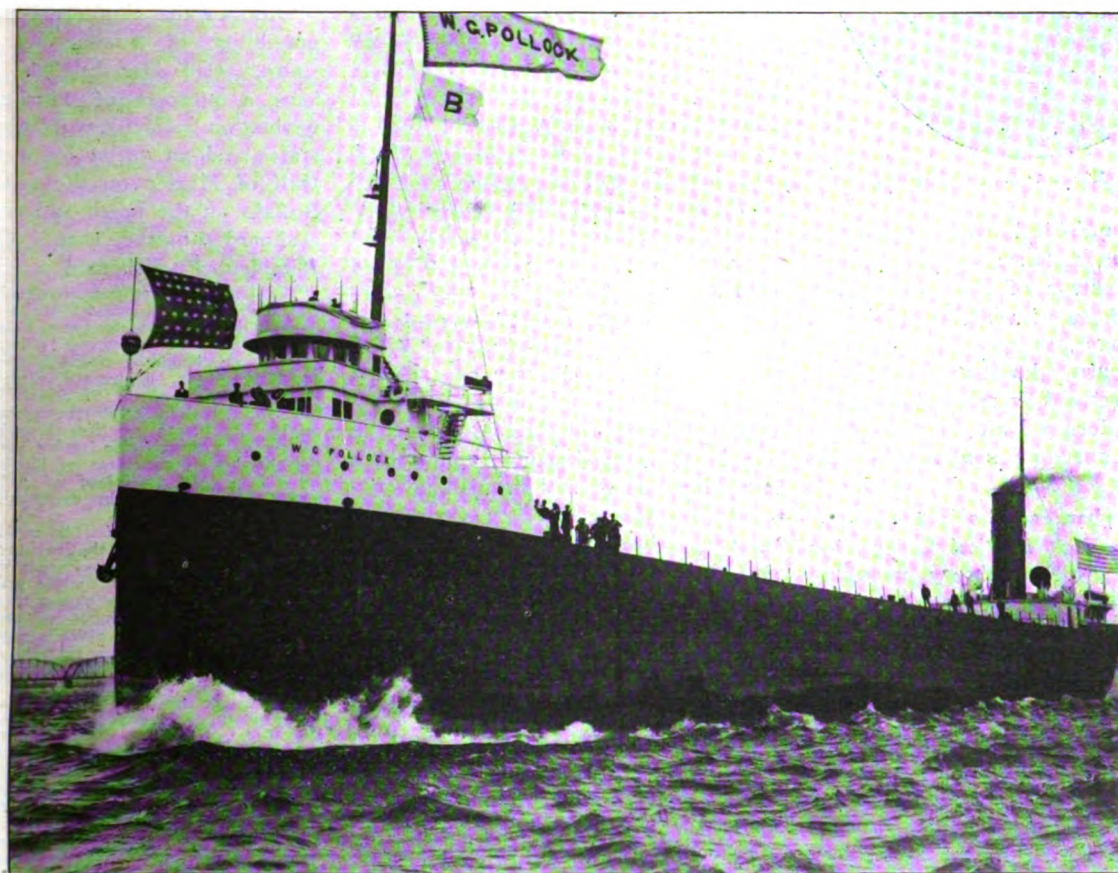
There are many lake freighters which are sumptuously fitted out, and among them is the steamer William G. Pollock, the flagship of William H. Becker's fleet. There is absolutely nothing lacking in her equipment and her furnishings. The Pollock made

the boat's name, William G. Pollock. The floors in the pantry, galley, mess, mates', wheelmen's and watchmen's rooms are of asbestos, while there is rubber tiling in the passengers' baths and asbestos in the captain's and chief engineer's.

The Pollock is a yacht, not only in

the captain what speed she is making. The log is carried over the starboard side, forward, to have it handy. It is 65 ft. from the water to the top of the pilothouse, when she is light.

Capt. Hubert G. Haybarger, who sails the Pollock, is a navigator with unlimited papers for either fresh or



STEAMER W. G. POLLOCK.

her first trip to Ashtabula last week, unloading at the Union dock. The captain's and passengers' quarters, including the dining room, are all finished in veneered oak panels, with the ceiling made in pulpwood panels. Hand painted flowers adorn the ceilings. The silver set is engraved with

her appearance, but also in her speed. She runs along light at fifteen miles an hour and can knock off twelve miles when loaded. She has never been crowded, but it is believed she could do better than this if she were. When she is underway, there is an indicator on the bridge which tells

salt water. His mate, A. W. Hayden, of Harrisville, Mich., is also a navigator, having secured his education with Lieut. Wilson, at the Chicago Nautical School. Ed. Reynolds, of Port Huron, Mich., is second mate. Capt. Haybarger, therefore, runs his boat in the same way that the largest

ocean liner is run, and he keeps an ocean log. This is a new departure, because lake captains generally have their mates write up the log.

The log the captain keeps is so complete that nothing could happen aboard ship without his having a record of it. It is divided in thirty columns as follows: Date, time, place or position, standard compass course, variation, deviation, leeway, send of sea or pro-



CAPT. HUBERT G. HAYBARGER.

pellor, geographical course, distance by propeller, distance by ship, slip in miles, percentage of slip, revolutions, log, wind, force of wind, sky, weather, sea, barometer, thermometer, steering compass course, deviation, bearing of objects terrestrial or celestial, distance of objects, fore an' aft trim, athwartship trim, consumption of fuel and remarks.

Capt. Haybarger, who is a graduate of the New York Nautical College, has a complete nautical library, including "Wrinkles of Navigation," and every conceivable instrument to assist him in his work. He has a bar azimuth circle, to figure the deviation with, and a pelorus, used for the same purpose. His steering compass is equipped with an adjustable compass which was lately adopted by the United States navy. He has a parallel rule cut to degrees and points, so no compass rules are needed on charts to obtain courses or bearings. He has a chronometer set on Greenwich time and a sextant fitted with sun and star telescopes, both direct and inverted. Compass observations are taken twice every watch and recorded by the officer of the watch.

It is said with considerable truth that it is up to the engineers on a boat to make her perform creditably.

In view of the fact, therefore, that the Pollock carried three cargoes between Cleveland and Superior in eleven days, Edward Reilly, the chief engineer, and L. W. Stewart, the second engineer, deserve credit for the good work done so far. One of the three cargoes carried was coal. The last trip up from Erie, the Pollock loaded coal for Duluth.

EXPERIMENTAL TANK FOR JAPAN.

Messrs. Kelso & Co., electricians and model makers, Glasgow, have received an order for all the apparatus for an experimental tank, which is to be constructed at the works of a leading Japanese ship building firm. The name of the firm has not yet been officially divulged, but it is almost certain to be the Mitsu Bishi Co., Nagasaki. This is the principal firm in Japan, and during recent years extensive improvements have been made at their works.

The new tank is to be practically a duplicate of that recently constructed in the yard of Messrs. John Brown & Co., Clydebank. It will have a waterway about 445 ft. in length, of which 400 ft. is deep, varying from 9 ft. at one end to 10 ft. at the other. The breadth will be uniformly about 20 ft., and in connection with the tank there will be small wet and dry docks for the storing of models, a drawing office, superintendent's office, the necessary rooms for preserving the records, and a department in which the models used in the experiments will be made. The making of the actual tank and the building covering will be done by Japanese contractors, but otherwise everything will be supplied by Messrs. Kelso, their contract including not only the carriage and recording apparatus, but also the dynamos, the model-cutting machinery, and even the rails on each side of the tank, on which the carriage supporting the apparatus will run. The intention of the ship building firm is that everything shall be in working order and capable of being tested in Messrs. Kelso's shop before being sent to Japan.

Like the Clydebank tank, that in Japan will have apparatus worked by electricity. As yet, Messrs. John Brown & Co.'s tank is alone in Britain in this particular respect, other tanks having steam as a motive power. Messrs. Kelso have already supplied the principal parts of the apparatus for the Clydebank tank, that at Messrs. Denny's yard at Dumbarton, the government tank at Gosport, one in Italy, and one in St. Petersburg.

FROM PITTSBURG TO THE SEA.

"Pittsburg needs a good shaking to wake her up to the realization of the opportunity presented in the near future, of vessels of 2,500-ton capacity being loaded at her wharves and sent by way of the Lake Erie and Ohio ship canal, Lake Erie, and Erie canal to New York city."

Such was the advice and prediction offered by President H. D. W. English, of the chamber of commerce. "In six years, at the furthest," continued Mr. English, "I predict this as an actual fact."

The chamber of commerce is about to enter upon an active campaign for the betterment of the wharves and landings in Pittsburg, following upon the improvement of the waterways. President English has every confidence in the hope that this city will soon attain marvelous growth through improved waterways and urges early preparation to take advantage of the opportunities to be afforded.

"Add to the ship canal project the possibility of a nine-foot stage to Cairo," said Mr. English, "and you have a prospect of Pittsburg having navigation which will embrace 24 states and an outlet by water to the Gulf of Mexico on the southwest, to Buffalo on the north and the Atlantic seaboard on the east. Continuing, President English said:

The United States has chartered a company which proposes to connect the waters of the upper Ohio river with Lake Erie across the "isthmus" at its narrowest point, where the annual interchange of traffic is now more than 30,000,000 tons, or nearly three times that traversing the Isthmus of Suez. While in its inception this is a Pittsburg enterprise, receiving its breath of life through the active efforts of a commission under the auspices of the chamber of commerce of Pittsburg, in reality it is a great project of national importance, and was so regarded by every speaker in the halls of congress.

The incorporators of this project have assured the public that the canal can be completed and opened to navigation within a period of about five years, while perhaps in less than five years we may expect to see the completion of the enlargement of the Erie canal upon which the Empire State is expending \$100,000,000. When finished vessels of 2,500 tons can pass from New York to Buffalo, and if the existing canal of only about 500-ton capacity exercises considerable regulative effect upon transportation charges between the lakes and the Hudson river, as shown by the reports of the inter-state commerce commission, there need be no misgivings as to the utility of the enlarged canal having a still greater effect.

With such a grand prospect before us, what efforts are being made by the city of Pittsburg to improve her harbor by adapting it to the large and deeply laden craft which will apply for admission to her wharves? The city has done nothing. Room is being more restricted. We must hold on to every foot of room we now possess, and secure more if possible, or regret it all ways.

Fortunate it is, indeed, that the city still controls some of its river front, for every square foot of this area will be needed for wharves for the receipt and discharge of freight. Not to speak of the present unsightliness of our river banks, which gather filth from every flood, it may be asked, are such sloping wharves adapted for landing places for vessels of 8 to 12 feet draught?

It is fortunate that the city owns the site of the Exposition building. The exposition is a worthy enterprise and has done and will continue to do much good for the city, but

long before its lease expires the association will feel that it has not area sufficient to do justice to an exposition of Pittsburg's industries. The site of the exposition then will become a welcome addition to the real harbor front.

It has been suggested that a portion of the sloping wharf along the Monongahela and Allegheny rivers might be dredged out and that a wall affording deeper water might be constructed, provided with numerous passageways opposite street ends for vehicles to reach vessels. Perhaps outside the wall there might be floating docks in sections for the deep craft to land against. Between the passageways from the street ends to the rivers along the parapetted walls, might be shade trees, fountains and statuary. Here would be a place strangers would delight to visit to while away the time while looking at vessels coming and going from Cincinnati or New Orleans, Chicago or New York, as chance may be, or find amusement in observing great crowds of Pittsburgers daily seeking pleasure in excursions on the wide, placid pools of the Allegheny or Ohio rivers. Nor is this a fanciful picture, the realization of which would cost many millions. It is a simple statement of what appears to be practicable on its face and well worth the expenditure of a considerable sum.

THE STEAM TURBINE.

To the September number of the *National Review* there is contributed an article on the "Development of the Steam Turbine," by the Hon. C. A. Parsons and Mr. H. C. Dakyns Jr. It is pointed out that from the original 10-horsepower turbine, built in 1884, we now have passed to the perfected machines more than a thousand times as powerful, which are at present in course of manufacture for the mammoth Cunarders *Lusitania* and *Mauretania*. Mention is also made of the fact that whereas the largest blades in the original turbine were barely $\frac{1}{4}$ in. in height, some of the blades in the Cunarders' turbines are over a foot in height. Dealing specially with the application of the turbine to marine work, the authors say that its application to ships gives the greatest promise of future development. Reference is made to the surprise created by the appearance of the *Turbinia* at the Jubilee Naval Review at Spithead, and to the absence of vibration and various aspects of economy which distinguish the turbine steamer. It is claimed that in no class of steamer where the turbine has been tried—and there are few types of vessels in which it has not been—has the result been unfavorable.

It is pointed out that the trials have yet to be made of a turbine-propelled battleship, but these will take place in the very near future. There is also an allusion to the trials made by the admiralty between the turbine cruiser *Amerthyst* and sister ships driven by reciprocating engines. The article proceeds:

The *Naval Annual* for this year, recently published, states that it understood that the admiralty has decided that practically all vessels being built for the royal navy, and not yet engaged, are to be fitted with Parsons' steam turbines as a means of propulsion. If the report be true, it tends to prove that the admiralty are entirely satisfied with the turbine vessels at present in commission.

Results just as favorable to the turbine have also been shown in comparative trials of the Midland Railway Co.'s steamers, in which the turbine steamer *Londonderry* was tested with two sister vessels similar in lines and boiler power, with the sole difference that the latter were propelled by reciprocating engines. On a six-hour trial the *Londonderry* had a speed of one knot per hour in excess of the other vessels working under exactly similar conditions. Apart from the gain in speed, there is also a great saving in the total weight of the propelling machinery—engines, shafting and boilers. In the case before us (that of the *Londonderry*) this saving amounts to about 150 tons. A slightly larger turbine steamer, the *Manxman*, owned by the same company, with somewhat greater boiler power, averaged a speed of 23 knots on her trial.

The turbine steamer *Viking*, belonging to the Isle of Man Steam Packet Co. has also been doing remarkably well. At the end of the tourist season last summer, after the engines had been opened up and examined by the Board of Trade surveyor, one of the company's officials stated that he did not know of any vessel being overhauled at so small an expense. This steamer recommenced service a few weeks ago; and in the first six round voyages, from Liverpool to the Isle of Man and back, the actual average speed maintained was $23\frac{3}{4}$ knots. The speed contracted for was only 22 knots. It is thought that this makes the *Viking* the fastest passenger steamer in service along these coasts.

The Clyde steamers *King Edward* and *Queen Alexandra* were the earliest passenger steamers to be fitted with turbines. In this connection a word must be said as to the enterprise of Capt. John Williamson, and of the firm of William Denny & Bros., of Dumbarton, to whose initiative the *King Edward* was due; for had it not been for their faith in the turbine system, its adoption for passenger vessels and in the merchant navy might have been considerably delayed. Capt. Williamson, as ship owner, and Messrs. Denny & Bros., as ship builders risked both money and reputation in the step they took; it was, therefore, particularly satisfactory to see the immediate measure of success they attained. As a consequence Messrs. Denny have already turned out no fewer than 16 vessels fitted with turbines.

The *King Edward* has now been on service for five seasons and the *Queen Alexandra* for four. Figures carefully collected since the day each went on service, as to the amount of coal used, number of passengers carried, and of miles run, in comparison with two paddle steamers on the same route, are exceed-

ingly satisfactory to believers in the turbine. The *King Edward*, up to the beginning of this year, had run 86,335 miles at an average speed of $18\frac{1}{2}$ knots, and had used 10,196 tons of coal, and this large mileage had been run with complete immunity from repairs to the main propelling machinery.

The *Queen*, perhaps, is the best known turbine steamer, having run on the Dover-Calais route since July, 1903. One of the steamer's characteristics is that she makes the voyage in bad weather or good in the same time to a few minutes. This ability to maintain smooth-water speed to a remarkable extent in a heavy sea is common to all turbine steamers. One explanation of the fact is that there is no tendency for the propellers to "race" as on ordinary steamers, a defect necessitating a slower engine speed in bad weather. With vessels of the ordinary type, as soon as pitching or rolling occurs to any great extent and the screw propellers come out of the water in the trough of the waves, the engines are inclined to work at a higher speed than designed for, and this increase of speed of the heavy reciprocating parts leads to excessive shaking felt throughout the whole ship. Now, with turbine vessels the propellers are very much lower in the water and, therefore, less liable to emerge; indeed, no case is known of their having emerged enough to allow the turbines to accelerate. Judging from a typical winter fortnight, it has been found that the *Queen* takes, on an average, fourteen minutes less every day than the quickest of her sister vessels on the short passage from pierhead to pierhead. The trials we speak of took place prior to the acquisition of the other two newer turbine boats, the *Onward* and *Invicta*, for the same service, which are regarded as proving even a greater success than the *Queen*.

On the Newhaven and Dieppe route the same tale is told in comparative runs of two sister vessels. The steamer *Brighton*, fitted with turbines, has shown at full speed a saving of more than 10 per cent in coal over a sister vessel fitted with triple-expansion engines of the most improved type.

The maneuvering and reversing qualities of these cross-Channel steamers, which have frequently very awkward harbors to negotiate, have turned out to be excellent; they start and stop quickly and promptly. For example, the *Queen*, steaming at 19 knots, has been brought to rest in 67 seconds, and in little more than twice her own length.

Equally satisfactory has been the experience with liners. The *Allan* line deserves the credit of being the pioneer firm to adopt the turbine system for

their large vessels for the Canadian service, in the Virginian and Victorian of 15,000 tons displacement. The ordinary mean speed attained on regular service across the Atlantic is rather more than 17 knots, and the highest average speed from land to land has been slightly under 18 knots.

In the Pacific, also, a turbine liner, the Maheno, has now begun to run between New Zealand and Canada. The Loongana, moreover, now trading between Australia and New Zealand must be mentioned among turbine steamers, if only because on her maiden voyage she went out to Australia in 30½ days at an average speed of 15 knots, as fast an average speed as that attained by the vessels carrying the weekly mails.

As marking a further step in the progress of the turbine, after the Allan liners must be named the Cunarder turbine-propelled Carmania, which is of 30,000 tons displacement. She, like other turbine steamers, has some advantage in speed over a sister vessel (in this case the Caronia), launched a few weeks earlier, and propelled by quadruple expansion engines, and, altogether, the results in service of this vessel have, it is understood, been extremely satisfactory. The Carmania, however, is herself overshadowed by the two giant steamships already mentioned.

These two vessels are being built, one on the Clyde and one on the Tyne, and are expected to be put into commission for regular service between Liverpool and New York some time next year; they are very similar, though not identical, in lines and dimensions, and will be by far the largest and fastest ocean steamers ever constructed. Their length is nearly 800 ft., and their breadth approaches 90 ft.; the displacement will be at least 40,000 tons, and they are expected to have an average service speed of 24½ to 25 knots, even in moderately rough weather. To maintain this speed the power of the main turbines will be far greater than has ever been installed on board any ship. The very great horsepower developed will be distributed over four turbines, each of which will drive its own propeller shaft; in addition, there will be two turbines for the purpose of reversing.

Each vessel will have six decks, and a feature of the complete arrangements on board is that there will be electrically-worked lifts for facilitating communication between the decks. The electricity required for these, and for other labor-saving appliances, as well as for the lighting of the vessels throughout, will be generated by four turbine-driven dynamos. That is to say, each steamer will have a central electric supply station of a capacity only exceeded at the

present day by some eighty towns in Great Britain, and corresponding to that of a town, say, as big as Ipswich, with a population of about 70,000.

Even on turbine-propelled ships there is, as a rule, still a certain amount of vibration perceptible, owing to the employment of small reciprocating engines for the air pumps, and the other auxiliary machinery of all kinds necessary on board ship. It seems possible, as on these new Cunarders, to obviate this discomfort by the introduction, in place of such engines, of motor-driven pumps, etc., and turbine-driven dynamos for generating the necessary electricity. In this way hardly a tremor should be felt, and in the saloons it should be almost impossible to detect whether the steamer's engines are at work or not.

There seems no reason to doubt that in these very large and fast liners unprecedented and phenomenal results as regards speed, economy of coal, and cost of upkeep and engine-room staff will be attained, advantages which should be accompanied by a great increase of comfort to all on board.

It only remains to remind the reader that in most of the comparative trials referred to, the turbine is being compared with modern triple and, in some cases, quadruple-expansion engines, which embody all up-to-date improvements, that is to say, with the reciprocating engine at its very highest stage of development.

According to Lloyds Register at the beginning of this year, out of sixty-eight vessels with a speed exceeding 20 knots, no fewer than ten use Parsons turbines in place of reciprocating engines. It must further be remembered that whereas so lately as five years ago there was only one passenger steamer afloat fitted with turbines, this summer nearly all regular passenger services between Great Britain and Ireland and Great Britain and the Continent are performed by turbine steamers.

We may venture to predict that the turbine will ere long entirely supersede the reciprocating engine in vessels of 16 knots' sea speed and upwards and over 5,000 indicated horsepower. This forecast might probably be extended to include vessels of speeds as low as 13 knots if of 20,000 tons and upwards, possibly to include vessels even lower in the scale, in course of time. As things actually stand at present, within the limits of what we may call the above-named most suitable field, is comprised something like one-fifth of the total steam tonnage of the world; nor must it be forgotten that whilst the speed of ships tends to increase and the turbine to improve, so also will the class of vessels suitable for the turbine become larger in like proportion.

To take a final survey of results achieved and of future prospects. Up to the present time this country has led the way in the development of the turbine, but it can hardly be doubted that just as engineers abroad have not been slow to see the advantages gained by the use of turbines on land for driving electric dynamos, so they will quickly turn to practical account the advantages to be derived from the employment of the same on ships. Such competition may be healthy; it is at any rate inevitable and must be faced. Meanwhile the fact that twenty-five of the greatest and most famous British ship building and engineering firms have already taken up the manufacture for ships of turbines of the Parsons type is doubly reassuring.

On what lines, it may be asked, can these future developments be looked for? It must be admitted, to begin with, that in a slow vessel, say, of 10 knots, it does not at present seem possible to replace reciprocating engines entirely by the turbine, for the following reason.

The small number of revolutions at which the propellers are driven would mean, for reasons already stated, a turbine of so large a diameter as to make the cost and weight prohibitive; while, on the other hand, it is impossible to increase materially the propeller revolutions by using a smaller propeller without greatly impairing the efficiency.

Difficult as the problem looks, at the present time, of attempting to replace the reciprocating engine altogether by turbines, yet there is apparently a gap that the turbine can even now most usefully fill. The engines of the ordinary coasting cargo tramp cannot, or at any rate do not, make full use of the steam raised by their boilers. After the steam has passed through the engines, a large amount of unused energy is wasted on its passage into the condenser. Three-quarters of this wasted energy can be utilized by a turbine—an additional auxiliary turbine we will call it—to be driven simply and solely by this steam, technically known as "exhaust steam." In this way, the steam, by help of the auxiliary turbine, instead of being wasted, will give additional power to drive the steamer, amounting to something like 20 per cent, at the extra cost of not a single pound of coal.

It is claimed that the fastest work done at the head of the lakes in unloading soft coal was in discharging the cargo of the steamer P. G. Walker, at the new Hanna dock at Superior a few days ago. In seventeen hours working time with three Mead towers, the cargo of 7,152 tons was unloaded. This was at the rate of 142 tons per hour per hoist.

TRIAL OF BATTLESHIP NEBRASKA.

The report of the Board of Inspection and Survey on the official trial of the battleship Nebraska, built by Moran Bros. Co., Seattle, Wash., has just been filed with the navy department at Washington. The board inspected the Nebraska on July 14 and embarked on her for the trial on July 16 over the Vashon island measured mile course. Just previous to the vessel's starting on the standardization runs, the draught was taken, and found to be:

Forward 23 ft. 10 $\frac{5}{8}$ in.
Aft 24 ft. 0 $\frac{5}{8}$ in.

Mean 23 ft. 11 $\frac{3}{4}$ in.
Corresponding displacement 14,985 tons

At 8 H. 59 M. 40 S. a. m., July 16, 1906, the Nebraska commenced her standardization runs, finishing at 12 H. 40 M. 00 S. p. m. During her trial the weather was overcast and misty, with light breeze from the south (mag.). Smooth sea.

12. The board constructed the speed curve appended, marked "C," from the following data:

Number and direction of run.	Interval between middle of runs.	Average of elapsed times observed.	Mean revolutions per minute.	Speed in knots
m. s.	m. s.			
1 N	24 58.7	3 07.8	121.710	19.169
2 S	21 21.4	3 05.15	122.639	19.444
3 N	22 22.8	3 08.83	124.078	19.063
4 S	21 39.3	3 04.35	119.389	19.528
5 N	15 53.7	3 12.95	125.372	18.658
6 S	10 54.6	3 00.4	124.296	19.956
7 N	11 25.1	3 19.63	115.729	18.033
8 S	11 51.2	3 03.8	119.975	19.587
9 N	14 08.4	3 22.3	111.228	17.795
10 S	16 18.0	3 29.0	98.849	17.225
11 N	17 26.9	3 34.1	104.060	16.815
12 S	16 01.4	3 28.8	100.157	17.241
13 N		3 51.6	92.563	15.544

Note: The data from which this table was constructed is given in the appended table marked "D".

The results of the runs with and against the tide having been plotted as separate curves, the curve of true speed was obtained, from which it is deduced that a mean of both engines of 119.85 revolutions per minute is requisite to a true speed of 19 knots.

After the standardization trial was completed, the draught was found to be:
Forward 23' 6 $\frac{5}{8}$ "
Aft 23' 10 $\frac{7}{8}$ "

Mean 23' 8 $\frac{3}{4}$ "
Corresponding displacement... 14,815 tons
Mean draught at time of middle of "high speed" runs. 23' 11" (est.)
Corresponding displacement... 14,940 tons

The board disembarked at 4 p. m. The board embarked on the Nebraska at Seattle, Wash., at 7:30 a. m., July 17, 1906, and that vessel got under way immediately and stood out into Puget Sound for the four-hours' trial.

On the morning of July 17, 1906, the draught was taken before getting

under way for the four-hours' speed trial and found to be as follows.

Forward 24' 1 $\frac{1}{8}$ "
Aft 23' 9 $\frac{3}{4}$ "

Mean 23' 11 7-16"
Corresponding displacement... 14,975 tons

At 8 H. 28 M. 49.5 S. a. m., July 17, 1906, commenced the four-hours' trial, as prescribed by contract, the ship steering N.W. to West (mag.). The weather was overcast and cloudy, with light breezes from south. Sea smooth. At 12 H. 28 M. 49.5 S. p. m., finished the trial. The data follows:

Hour of day	Elapsed time	Total revolutions Each 15-minute period	Average revolutions per min. both engines.	Corresponding speed by revolutions.
h. m. sec.	h. min.	Stbd. engine.	Port engine.	Mean revolutions.
8:28:49.5	(Beginning of run)		
8:43:49.5	00:15	1822.3	1793.6	1807.95
8:58:49.5	00:30	1832.3	1784.5	1808.4
9:13:49.5	00:45	1841.8	1811.5	1826.65
9:28:49.5	1:00	1843.3	1799.0	1821.15
9:43:49.5	1:15	1854.4	1823.6	1839.00
9:58:49.5	1:30	1845.1	1800.0	1822.55
10:13:49.5	1:45	1832.0	1788.5	1810.25
10:28:49.5	2:00	1851.0	1766.9	1808.95
10:43:49.5	2:15	1810.7	1753.6	1782.15
10:58:49.5	2:30	1812.2	1752.0	1782.10
11:13:49.5	2:45	1823.7	1748.4	1786.05
11:28:49.5	3:00	1845.6	1790.4	1828.0
11:43:49.5	3:15	1838.3	1783.3	1810.80
11:58:49.5	3:30	1826.05	1771.4	1798.72
P. M.				
12:13:49.5	3:45	1826.05	1771.4	1798.72
12:28:49.5	4:00	1821.8	1769.7	1769.7

Average revolutions per minute, 120.49; corresponding speed from curve, 19.06 knots.

As the vessel made a straightaway run, it was not possible to obtain her draught when the trial was completed, but it was estimated that the draught at the middle of the four-hours' run was 23 feet 9 7-16 inches, and the corresponding displacement 14,865 tons.

After completing the four-hours' full-power trial and while the vessel was still under forced draft, the steering gear was tested in the following manner: The helm was put hard a-port (35 deg.) in 10.4 seconds; the time to swing her through 360 deg. with full helm was 3 min. 40 seconds. The helm was then shifted from hard-a-port to hard-a-starboard in 16.8 seconds by the bridge indicator. The helm was then put amidships in 8.4 seconds. The maximum heel was 3 degrees, and the estimated diameter of the turning circle was 350 yards.

After completing the above tests of the steering gear, the helm was put amidships, and after the vessel had gathered full headway on her course, the steam-reversing gear of the main engines was reversed, the engines being started astern, and after they began to work astern at full speed, they were brought to full speed ahead.

After the fires had been reduced sufficiently to keep the steam pressure under control, the helm being

amidships, the engines were reversed; and when making 60 revolutions per minute astern, the vessel was allowed to gather stern board for two minutes; the helm was then put 15-deg. starboard, then 25-deg. port, then 30-deg. starboard, then 35-deg. port, then 35-deg. starboard, and allowed to remain at each of these angles for two minutes. The helm was then put amidships.

During the above tests, the general operation of the steering gear was satisfactory.

The Nebraska then proceeded to Seattle, Wash., and the board disembarked at 7:30 p. m.

The report of the naval constructor member of the board, and the report of the board on the trial of the machinery, are appended, marked "E" and "F" respectively.

Certificates from the equipment and ordnance inspectors at the contractors' works, relative to unfinished work on the Nebraska in their respective departments, are appended, marked "G" and "H."

The weight of machinery, including water in the boilers, condensers, etc., in accordance with clause 10 of the contract, is shown by the report of the inspector of machinery at the contractors' works to be 1,681 tons.

The working of the machinery, both main and auxiliary, and its performance during the trials was satisfactory except the priming of boilers caused by leaky tubes in main condensers. The boilers steamed freely and worked in a satisfactory manner throughout the trials, except the priming of same. A careful observation and inspection of the various parts of the machinery during and after the trial showed the engines, boilers, and appurtenances to be in excellent condition, with the exception of defects noted in the report of the board on the trial of the machinery, appended hereto.

The following is a summary of the observations recorded in the log during the four-hours' trial:

last year's naval program, was successfully launched with all machinery on board from the company's Chis-

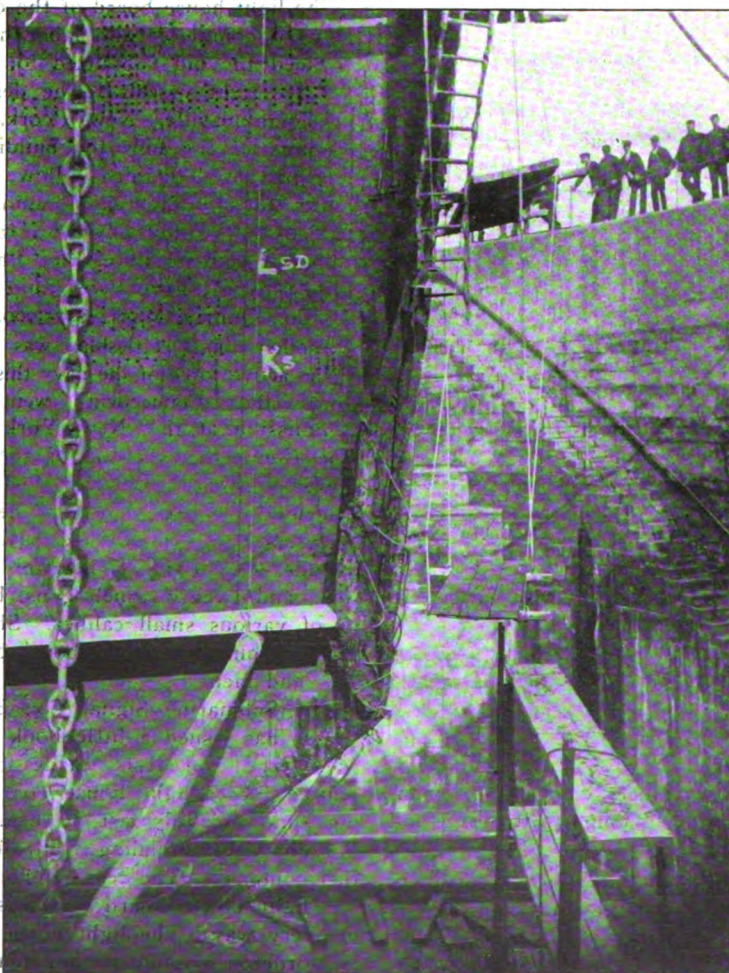
FOUR HOURS FULL POWER FORCED DRAFT PRELIMINARY TRIAL
OF U. S. S. NEBRASKA AT PUGET SOUND, JULY 17, 1906.

	Starboard.	Port.
Maximum average revolutions per minute for 15-minute period.....	123.6	121.5
Average revolutions per minute, four hours.....	122.19	118.78
Mean revolutions per minute, both engines.....	120.49	
Maximum steam pressure at boilers, in pounds.....	285.3	
Average steam pressure at boilers, in pounds.....	271.3	
Maximum steam pressure at engines, in pounds, H. P. steam chest.....	257	251
Average steam pressure at engine.....	250	238
Maximum air pressure in fireroom.....	2.03	2.03
Average air pressure in fireroom.....	1.55	1.55
Maximum vacuum, each engine.....	25	25.5
Average vacuum, each engine.....	19.5	25.2
Collective I. H. P. of all main engines.....	20946.8	
Collective, main engine, air, circulating, feed, and hot well pumps.....	21282.8	
Collective, main, and all auxiliary engines in operation during trial.....	21910.6	
Kind and quality of coal used on trial, Cardiff, coarse screened.....	excellent	
Average pounds of coal used per hour during trial.....	61991	
Pounds of coal per hour used by main and all auxiliary engines in operation during trial.....	2.83	
Pounds of coal used per hour by main engines, air, circulating feed, and hot well pumps.....		
Pounds of coal used per hour by main engines alone.....		
Draught at beginning of trial (forward).....	24 ft. 17 in.	
Draught at beginning of trial (aft).....	23 ft. 9 in.	
Mean draught at beginning of trial.....	23 ft. 11 7/16 in.	
Corresponding displacement at mean draught at beginning of trial.....	14975	
Corresponding displacement at mean draught during trial.....	14865	
Speed of ship in knots, per hour.....	19.06	
Slip of propellers in per centum of their own speed.....	17.023	14.453

LAUNCH OF GLOW-WORM.

H. M. S. Glow-Worm, the second to be completed of five coastal destroy-

wick Works, by Mrs. Maughfling, the wife of the secretary of the company, in the presence of Engineer Com-



DEUTSCHLAND'S BOW AFTER THE RECENT ACCIDENT.

ers ordered from Messrs. John I. Thornycroft & Co., Ltd., of Chiswick and Southampton, in connection with

mander Willoughby, R. N., Mr. S. Mummery, Mr. and Mrs. John Thornycroft, Mr. Maughfling, and a

number of others interested. The dimensions of the class to which the Glow-Worm belongs are: Length, 168 ft., beam, 17 ft. 6 in., draught, 5 ft. 11 in. The contract speed is 26 knots. The Glow-Worm is fitted with turbine machinery of Parsons type, built by Messrs. Thornycroft, at Southampton and Thornycroft water tube boilers. The armament will consist of two 12-pounder quick-firing guns and three torpedo tubes. The first of the five 26-knot destroyers for which Messrs. Thornycroft secured the contract was the Gadfly, which was launched on May 24 last. She was the first of twelve boats of this class to attain her contract speed, which she did in a preliminary trial in rough weather; attaining a speed of 26.05 knots.

MARINER'S CREED.

"I believe in the lead, as it guards me against dangers which the eye cannot see.

"I believe in the lookout, as it guards me against dangers to be seen.

"I believe in the log as it checks my distance run.

"I believe in ascertaining the latitude as it helps me to define my position.

"The lead guards me against dangers invisible. The lookout guards me against dangers visible. The log guards me against false distances, and the latitude helps me to define my position.

"I earnestly resolve and openly declare that as I hope to go all my days in safety, therefore, will I steadfastly practice that which I believe, and I hereby warn seamen and tell them that if they ever neglect these four things: Either the lead, the log, the latitude or the lookout, they and their fellow creatures will some day surely perish."

The report of the Manchester ship canal for the past six months shows an increase in tonnage and revenue, the tonnage figures being 2,112,813 as against 1,865,606. Imports and exports of general merchandise furnished 176,303 tons of this increase, the balance consisting of 70,904 tons of larger shipments of coal. The monetary receipts amounted to £233,176 as compared with £208,745 last year, an increase of £24,431.

Lieut. Comdr H. P. Norton, of the bureau of steam engineering navy department, has been detailed to make an observation trip on the Cunard liner Carmania.

SHIPPING TIED UP.

Baltimore, Md., Oct. 9.—This city is now suffering from the most serious interruption of bay traffic in the history of the port. Thirty vessels of the Baltimore, Chesapeake & Atlantic and Maryland, Delaware & Virginia railway companies are lying idle at their piers, as the result of the resignations of captains, mates and quartermasters on Oct. 1. Farmers who cannot get their fertilizers from Baltimore, for the planting of crops, are being put to serious loss by the quitting of the steamer officers.

The men who have quit the boats of the two companies have a practical monopoly of the privilege of navigating on Chesapeake bay, by reason of their government licenses. The number of these licenses is comparatively limited, and it is impossible to get other men to take charge of the vessels. Only two or three answers came in response to an advertisement, published in the newspapers, asking for licensed officers.

At the bottom of the trouble is the refusal of the captains, mates and quartermasters to go to Capt. Willard Thomson, vice president and general manager of the two companies, personally, and state their demands. They put their petition for a new wage schedule in the hands of a committee from the American Association of Masters, Mates and Pilots, and this committee presented it to him. He said that his own employees ought to come to see him if they had anything to ask, and that he could not discuss the question with outsiders.

In June the committee presented a petition bearing the names of many of the licensed officers of the vessels. Enclosed was the wage schedule, which, the letter asked be applied to the men employed on the companies' vessels. After that, for three months, nothing was done until Sept. 20, when Capt. Thomson received another letter from the committee, enclosing the resignations of the officers of the vessels. They quit Oct. 1.

The condition of affairs finally became so serious that the Maryland Bureau of Statistics and Information began an inquiry. To that body Capt. Thomson expressed his willingness to see the men and settle the question of wages. Since the vessels were quit by their captains, Capt. Thomson has extended several repeated invitations to them to visit him and talk their complaints over. But they have refused to do this and insist that he must deal with the outside committee.

A few of the captains and other officers have remained loyal to the companies and are operating their vessels as usual. Four of the steamers are kept continually moving, carrying, chiefly, fertilizers for the farmers in the district reached by the companies' vessels. The

companies have put their wharves at the disposal of shippers, without charge, so that those who may be able to send their products on barges and lighters will have ample facilities for doing so. The wharves are also open to men who have chartered freight boats and are operating them to relieve the congestion of freight. In discussing the situation, Capt. Thomson said:

"I am willing now, as I have been, to see the captains, either individually or collectively, and hear their complaints. If we meet, I have no doubt that we will be able to make a readjustment satisfactory to all parties."

ITEMS OF GENERAL INTEREST.

The Northwestern Commercial Co. has just given a contract to the Moran Co., Seattle, Wash., for the construction of a freighter 284 ft. long, to cost \$250,000. The keel for the new boat has just been laid and the craft will be completed by June 1, 1907.

Work on the new B. & O. pier at Locust Point, which is being built by the McLean Contracting Co., is progressing rapidly. All the cases for the construction of the concrete wall are nearly completed and are now ready to fill.

Baltimore & Ohio employees to the number of 5,000, making up five regiments, marched in the great industrial parade at Baltimore recently. With white hemlets and blue coats, each man carrying a cane, clerks and workmen of this great railroad corporation made a splendid showing.

The first of the two large car floats, building for the New York, Philadelphia & Norfolk Railroad Co., was recently launched at the yard of the Maryland Steel Co., Sparrow's Point, Md. The float is 340 ft. over all, 338 ft. between perpendiculars, 48 ft. three inches beam, and 12 ft. six inches deep. She will have a capacity for 28 cars. The hold will be kept free from water by a donkey boiler and pump, with an overhead bridge amidships.

The steamer Washington, which was launched at the yard of the Washington Marine Co., Seattle, Wash., was built in ninety days. The Washington is 174 ft. long, 35 ft. beam and 12 ft. six inches deep. Her engines are compound, fore and aft, with 17 by 30 in. cylinder diameters by 20-in. stroke. Steam will be supplied by a Scotch boiler, and oil will be used as fuel. She will have accommodation for 24 first cabin and 74 second cabin passengers. The electric lighting plant, a five-kilowatt, direct-connected machine, will be installed by the Under-

writers Electric Co. The Washington was designed by Mr. John J. Hill and her construction was under the direction of John Sloan.

The annual meeting of the stockholders of the Allis-Chalmers Co., Milwaukee, was held at Jersey City, N. J., Sept. 6. Mr. W. H. Whiteside was elected president. The reports indicated the company to be extremely prosperous, having on its books \$4,500 worth of orders for classes of machinery not hitherto manufactured by this company.

The steamer Oregon, of the Northwestern Commercial Co.'s fleet, which went on the rocks of Hinchbrook island, is expected to be a total loss. She was built at Roach's in 1873.

The United States submarine torpedo boat Octopus was launched from the works of the Electric Boat Co., at the Fore River ship yard at Quincy, Mass. The Octopus is the largest submarine boat in the United States navy, and is within a few tons of the largest in the world. Her sister ship, the Cuttlefish, was launched Sept. 12.

The light house board of the department of commerce and labor has announced the bid submitted for building five light vessels to be delivered at Tompkinsville, New York. The amounts of the bids for building all five of the lightships follow: New York Ship Building Co., Camden, N. J., \$495,000; William Cramp & Sons Ship & Engine Building Co., Philadelphia, \$574,700; Fore River Ship Building Co., Quincy, Mass., \$575,000.

Another big battleship was added to the active force of the navy this week, when the Connecticut went into commission at the New York yard. The Connecticut is one of the most powerful ships of the navy. Her displacement is 16,000 tons, and her contract speed 18 knots. Her armament includes four 12-in., eight 8-in., twelve 7-in., and twenty 3-inch guns, besides 30 of various small caliber. She will have a complement of about 900 officers and men.

The Submarine Signal Co., Boston, Mass., has issued a little book giving the results of tests made by the United States light house board during June and July last of the system of submarine signaling controlled by this company. The test conducted by the light house board was a success in every way. The light house board has ordered equipment for ten light ships, with the understanding that six others are to have the apparatus installed upon them immediately. Steamship lines interested in this system would do well to write to the Submarine Signal Co. for this pamphlet.



DEVOTED TO EVERYTHING AND EVERY
INTEREST CONNECTED OR ASSOCIATED
WITH MARINE MATTERS ON THE
FACE OF THE EARTH.

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CANADIAN SHIPPING SUBSIDY.

Under the general title of mail sub-
sidy and steamship subventions the
Dominion of Canada has voted the
following appropriations for the ensu-
ing year:

MAIL SUBSIDIES AND STEAMSHIP SUBVENTIONS.	
Canadian-Great Britain mail service ..	\$ 275,000
Seven other services to Great Britain ..	108,000
Canada and Australia	152,357
Canada and New Zealand	37,500
Canada and South Africa	109,500
Canada and Mexico	77,500
St. John and Halifax to West Indies and South America	60,525
Four services on the Pacific coast....	17,325
Service to Pelee Island, Ont.....	1,500
Twenty-nine services between Quebec and Maritime Province ports, New- foundland, etc.....	180,981
Total	\$1,020,188

That Britain subsidizes her shipping
is, according to British papers, "an his-
toric lie." What is the difference be-
tween this appropriation and subsidy?
Does anyone pretend that the small
space occupied by the mails aboard a
steamer is worth any such sum of
money? Yet the sum of \$1,020,188 is

appropriated by the Dominion alone. Add to this the appropriations of Bri-
tain herself and her other colonies and
we get a respectable sum indeed.

AN OPEN LETTER TO SECRETARY OF STATE ROOT

We are very much interested in the
building up of American shipping in
the foreign trade. In view of the fact
that you were compelled to use an
American warship to suitably convey
you directly to Brazil, on your recent
tour of the South American countries,
or that otherwise you would have been
compelled as American passengers
and American goods are, to be first
conveyed to Europe, and thence to
Brazil, we feel sure that you, too,
must be deeply impressed with the
need of adequate legislation for the
upbuilding of our foreign-going mer-
chant marine. Besides, the Brazilian
officials and leading business men
must have told you, as American am-
bassadors and consuls to that country
have long been telling our people,
that existing steamship communication
between the United States and Brazil
is antiquated, irregular, excessively
costly, and quite unsatisfactory. They
must have told you, as they have tried
to make clear, over and over again,
to the American people, their desire
for closer commercial relations, and
they must have pointed out that until
regular sailings of commodious, large
and swift American steamships be-
tween the two countries are inaugu-
rated, such closer relations are impos-
sible. You must have learned that,
despairing of persuading the United
States to do the right thing in the es-
tablishment of an American line of
steamships, the Brazilians themselves,
although not a maritime people, have
become so deeply impressed with the
need of better service, that they have
but recently placed a fleet of steam-
ship on the line. If you were correct-
ly informed, you must know that these
are indifferent steamships, as to size
and speed, and not likely to build up
the larger trade awaiting the inaugu-
ration of a first class American line.
Doubtless you learned that most of
our goods, destined for Brazil, reach
there via Europe.

Equally impressive must have been
your observations and information in
the Argentine Republic and in Uru-
guay, when you reached the Rio de
la Plata, as to the pressing need of
at least one direct line of American
steamships between the United States
and that section of the world. You
must have been deeply impressed with
the vast commerce conducted with the
rest of the world by the Argentinians,
and the fact must have been clear to
you that an equally important and
profitable trade awaits the establish-
ment of an American line. Perhaps
you were not informed, but the files
of the department of state will prove
to you, that for a matter of ten or fif-
teen years the Argentine Republic re-
peatedly offered a subsidy of \$100,000
a year, provided the American govern-
ment would pay an equal subsidy, to
a direct line of American steamships
of adequate size and speed between
the two countries. Of course, you
know, our government did not accept
the generous offer thus made.

When you reached Chili, doubtless
one of the first things that you were
told by the Chilean officials was that
they had deputed one of their most
prominent citizens to come to the
United States to induce our govern-
ment, if possible, to agree to join with
Chili in establishing a subsidized
American line of large, swift ships
to run between Chilean ports and Pan-
ama, in order to increase the trade
between the two countries. That offi-
cial, we understand, is still in the
United States, temporarily filling the
office of consul general, and located
at Pittsburg, but only awaiting a fav-
orable opportunity to open negotia-
tions respecting the establishment of
such a line. Doubtless you saw the
vast trade carried on by the Chileans
with other parts of the world, and
were informed of the desire of the
people of that country for direct
steamship communication, in regular

lines, via the Straits of Magellan and our Atlantic seaports? It must have been obvious to you, as it is to Chilians and to Americans attempting to do business with them, of a stable and increasing and prosperous character, that, under present conditions, and especially lacking direct steamship lines of communication, nothing in the way of larger trade relations is possible?

In Peru, when you reached that progressive country, unquestionably you learned that arrangements have just been made by its government to subsidize a Peruvian steamship line between Peruvian ports and Panama, in order to increase the trade between Peru and the United States. The officials and the people of Peru must have found occasion to emphasize their need of better steamship communication, their despair of the United States doing anything, and their own attempts to accomplish that which we seem to be unwilling to do. They very likely told you how much they would like to see an American line of fine, large, swift steamships running regularly between American and Peruvian ports, and the many efforts they have made to induce our government to offer the inducements to American steamship owners necessary to enable them to establish such a line of steamships as their present and prospective trade will justify?

We do not doubt but that the files of your great department contain many communications from the various republics of South and Central America, suggesting that our government extend its aid to American steamships in sufficient number to justify their owners in establishing direct, regular and frequent service between our country and theirs.

We would very respectfully refer you to the files of your department and to the records therein of the proceedings of the Pan American Congress held in this country in 1889 and 1890, which congress or conference was participated in by all of the republics of this hemisphere. For your immediate information we quote from their report of the committee on Communication with the Atlantic:

First. The committee on Communication on the Atlantic resolves to recommend to the respective governments the aiding of one or more lines of steam navigation between ports of the United States and those of Brazil and Rio de la Plata.

Succeeding articles read as follows:

Second. The companies receiving government aid should establish a fast bi-monthly service of steam navigation between the ports of the United States, Rio Janeiro, Montevideo and Buenos Ayres, and the vessels shall have accommodations and capacity necessary for the transportation of freight and passengers, and shall carry the mails.

The fourth article provides that the speed of fast steamships shall be at least 16 knots an hour, and that the vessels shall be of not less than 5,000 tons.

The fifth article provided for the establishment of "auxiliary lines" of freight steamships, to sail twice a month, to be of not less than 12 knots an hour, each country (the United States and Brazil) to "pay one-half each of the amounts paid to these vessels" in the way of subsidies.

The eleventh article proposes to apportion the proportionate amounts of the subsidies between the several governments participating on the following basis: The United States, 60 per cent; Brazil, 17½ per cent; Argentina, 17½ per cent, and Uruguay five per cent, in the case of regular, swift lines running to all of the several countries.

We quote the twelfth article, in full, as follows:

TWELFTH. THE CONTRACTING STATES SHALL ACCEPT ONLY VESSELS CONSTRUCTED IN THE UNITED STATES, IN CONSIDERATION OF THE HIGHER AID PAID BY THAT GOVERNMENT.

As the files of your office will show, these recommendations were officially favored by the representatives of sixteen American republics, who unanimously voted for their adoption. Those republics were: Nicaragua, Peru, Costa Rica, Brazil, Mexico, United States, Chili, Guatemala, Argentine, Columbia, Paraguay, Honduras, Bolivia, Venezuela, Salvador and Ecuador.

The official files of your department will also show that a similar recommendation was made by the committee which submitted the report on Communication on the Pacific, in which the sum of 30 cents per gross registered ton per thousand miles sailed should be paid by the participating countries to a steamship line of vessels of not less than 4,000 gross tons register, and with 3,500 I. H. P. engines.

There was still another report of

that great Pan American conference, that was unanimously adopted by fourteen republics, on March 21, 1890, also to be found in the official files of your department. We refer to the report of the committee on Communication on the Gulf of Mexico and the Caribbean sea, the last paragraph of which reads as follows:

In view of the proximity of all the ports of the Gulf of Mexico and the Caribbean Sea, the advantages that would accrue from increased social, commercial and international intercourse, their dependence upon proper communication, THE IMPROBABILITY THAT THIS WILL BE ESTABLISHED BY UNAIDED PRIVATE ENTERPRISE, the duty of the governments to promote public welfare, the small public expenditures required to secure adequate mail, passenger and freight facilities, and the necessity for their control by the countries whose interests they should subserve, the International American Conference recommends to all the nations bordering upon these waters the granting of government aid in the establishment of first-class steamship service between their several ports upon such terms as they may mutually agree with reference (a) to the service required, (b) the aid it is necessary to extend, (c) the facilities it will severally afford them, (d) the basis upon which they are to contribute, (e) the amount that each is to pay, (f) the forms of agreement between the several governments, and the nature of the contracts with steamship companies necessary to the successful execution of a general plan for such service.

The Pan American Conference held in Mexico a few years ago reiterated in explicit terms the views of the countries concerned in the development of more frequent, direct, regular and swift steamship communication between themselves and the United States. While the official reports of the Pan American Conference held in Brazil, this year, and in which it was your good fortune to participate, are not before us, from what we have seen in the press we are satisfied that the views so long entertained, emphasized as they are by the passage of time and the meagre results of the furtive and unsatisfactory steamship service between the United States and a few of the Latin-American republics, were in line with previous expressions at other Pan American conferences.

We have to the south of us a population of between 60,000,000 and 70,000,000 people, soils marvelously productive, rich in natural products, their people requiring, and buying from European countries, many of the articles which we could as cheaply and as well furnish them, which peoples at the present time conduct a foreign commerce valued at between \$1,500,000 and \$2,000,000 annually, in which the United States participates to the extent of about

twenty per cent, our imports being about double our exports.

From the foregoing it must be convincingly clear to you: 1. That the republics of this hemisphere are a unit in desiring the establishment of lines of American steamships, giving each with the other regular, frequent, direct and rapid communication. 2. That they realize that government aid, or subsidies, is necessary to secure the establishment of such lines, because they severally and unitedly say so. 3. That the results would be permanently beneficial to all of the republics of this hemisphere, promotive of better and more intimate social relations, better trade relations, and that degree of confidence and interdependence so much desired by us all.

Convinced as we believe you must be of the truth of all that we have said and as most of what we have said has already been said, officially, and is a part of the records of your own department of state of the United States, will you not, in the report that you are to make, resulting from your trip, make these facts as sensibly impressive to the American people, and especially to the American congress, as they are to you?

AROUND THE GREAT LAKES.

Repairs to Ann Arbor car ferry No. 2 which has been in dry dock at Milwaukee since June 2 have been completed.

A revision in colors of coast chart No. 2, Lake Erie, has just been issued by the United States Lake Survey and is for sale by the MARINE REVIEW.

The steamer La Salle ran aground at Sailor's Encampment recently, but was released after lightering 300 tons of ore.

The 9,000-ton steamer which is to be built by the Great Lakes Engineering Works of Detroit for the York Transit Co. will be managed by John J. Boland, Buffalo.

Repairs to the steamer Charles W. Elphicke, which went on the extension of the east arm of the Cleveland breakwater about two months ago, have been completed.

The steamer Benton and barge A. Cobb ran aground on the north end of North Bass island. As they are in the lee of the island, they are in not in any special danger. Part of the Benton's cargo has been removed.

It is announced that the Great Lakes Engineering Works, of Detroit, will supply all the steel tubing for a tunnel under

the Detroit river to be constructed by the Michigan Central railroad. The tubing will be turned out at the St. Clair yard.

The passenger steamer Peerless of the Chicago-Milwaukee line bound from Chicago to Milwaukee, became disabled off Racine last week, and in response to a signal of distress, was towed into that port by the tug S. M. Fisher.

Capt. John Nahrstedt, master of the steamer Alex. McDougall, reports that he passed a crib about 40 ft. square in Pelee passage on the down trip. The obstruction when sighted by Capt. Nahrstedt was about two miles east of the Middle Ground light.

The steamers Henry C. Frick, 569 ft. long, and the Edward Y. Townsend, 602 ft. long, have been taken into the old river bed at Cleveland, thus showing that it is possible for the largest vessels on the lakes to enter the port of Cleveland.

The United States cruiser Morrell and the Canadian cruiser Vigilant have started the work of setting buoys to mark the boundary between American and Canadian waters on Lake Erie. The placing of buoys at intervals of five miles, it is hoped, will eliminate all annoyances between fishermen of the two countries.

W. R. Richardson and L. L. Henderson appeared before the grain commission at Kingston last week and urged the enlargement of the Welland canal to admit the passage of the 10,000-ton freighter. This would mean to more than double the size of the locks and to deepen the canal by 8 ft.

Capt. John Lowe, of Cleveland, will bring out the new steamer Peter A. B. Widener for the Pittsburg Steamship Co. The Widener will be launched during the present month from the yard of the South Chicago Ship Building Co. She is the last of the 600-footers ordered by the Pittsburg Steamship Co. for 1906 delivery.

That energetic effort counts on a steamboat as well as on shore is shown by the personnel of the steamer Linn's crew. Wm. Sherston, oiler, started decking on the German two years ago. George Palmer, fireman, decked on the German last season. Will Roberts, fireman, started decking on the Linn this season. They all got their first training from Mate Charles Benson, who was formerly on the German, and Joseph Wagner, second mate of the Linn.

The barges Wayne and S. H. Foster stranded on the shore off Misery Bay, Lake Superior, this week. The crew of the Wayne found it comparatively easy

to reach shore, but the Foster's crew were imprisoned on the stranded ship by a stretch of boiling surf. Edward Jacobson, one of the Foster's crew, tied a line about his body and after a terrible struggle succeeded in reaching land. The remainder of the crew were taken ashore by the life line thus constructed. The Foster is resting on a sandy bottom and can probably be released if the weather continues good. The Wayne is lying on the rocks and is in great danger.

Captains, who are trading to Ash-tabula, have complained about the absence of any light on the easterly concrete pedestal at the harbor entrance. This pedestal is 50 ft. square and it is only 450 ft. from the one on which the lighthouse stands. With a heavy sea running over the unfinished breakwater, and with a strong cross current sweeping either way across the entrance, the captains assert there is absolute danger attached to coming through the entrance at night. Men connected with the harbor work have also noted the danger, but no steps have been taken to improve or remedy the condition.

The changes in the lumber rates as announced by the Lake Carriers' Association are as follows: From ports on the western half of Lake Superior, to lower Lake Michigan ports and ports between Lake Huron and Lake Ontario, \$3; from the eastern half of Lake Superior to the same sections, \$2.75; from Georgian Bay to the same ports, \$2.50; from Lake Huron ports to ports between it and Lake Ontario, \$2.25; from Georgian Bay to sections first named, free on rail, \$2.37½; from the same to the same; when taken from the dock, \$2.50; from ports on the upper half of Lake Michigan to ports between Lake Huron and Lake Ontario, \$2.50; from lower Lake Michigan ports to ports between Lake Huron and Lake Ontario, \$2.62½; from the head of the lakes to Lake Ontario, \$1 over the Buffalo rate, or \$4 a thousand; from the head of the lakes to Oswego or Kingston, \$1.25 over the Buffalo rate, or \$4.25 in all; from the head of the lakes to Bay City, \$2.75. Rates on heavy timber and special timber will maintain the same relative advance over the new rate as formerly prevailed. Cedar and all other commodities are advanced in proportion to pine rates.

Thomas Cooper, of Amherstburg, Ont., who was master of the schooner Armenia when she foundered earlier this season on Lake Erie, is mate on the steamer Mecosta, of the Gilchrist fleet.

FREIGHT SITUATION.

Inclement weather and especially western winds, which have seriously lowered the water at the Lime Kiln crossing, have interfered greatly with the ore trade during the last few days. Few vessels have arrived at Lake Erie docks and practically everything in port has been cleaned up. The water at the crossing reached the low stage of 17 ft. 8 in. on Tuesday and held up more than a score of large carriers. A number of the larger carriers are taking grain cargoes. A diversion of some of the modern carriers to this trade can be expected from now on. Coal is still slow in going forward, owing to the shortage of cars. Following are the ore shipments by ports for the month of September and to Oct. 1, with data for corresponding periods last year:

Port.	Sept. 1905.	Sept. 1906.	To Oct. 1, 1905.	To Oct. 1, 1906.
Escanaba	706,490	833,681	3,925,355	4,270,292
Marquette	377,623	411,582	2,259,834	2,120,519
Ashland	437,843	384,968	2,586,194	2,636,025
Superior	698,752	869,678	3,866,778	4,448,174
Duluth	1,197,887	1,750,116	6,787,378	8,334,388
Two Harbors	1,015,955	1,179,635	6,048,067	6,341,357
1906 increase	4,434,550	5,429,660	25,473,606	28,150,755
		1,004,110		2,677,149

CONTRACT FOR EIGHT STEAMERS.

The largest and most important single ship building deal ever closed on the great lakes was made this week by Mr. J. C. Wallace, president of the American Ship

1. Five of the steamers will be of the 7,000-ton class, and will be duplicates of the steamers W. G. Pollock and Joshua Rhoades. They will therefore be 440 ft. over all, 420 ft. keel, 52 ft. beam and 28 ft. deep. They will have triple-expansion engines with 22, 35 and 58-in. cylinder diameters by 40-in. stroke, supplied with steam from Scotch boilers, 13 ft. 9 in. by 11 ft. 6 in., fitted with Ellis & Eaves draft, and allowed a working pressure of 180 pounds.

Three of the steamers will be of the 8,000-ton class, being 500 ft. over all, 480-ft. keel, 52-ft. beam and 30 ft. deep. They will have triple-expansion engines, with cylinder diameters 22½, 36 and 60 in. by 42-in. stroke, supplied with steam from Scotch boilers, 13 ft. 9 in. by 11 ft. 6 in., fitted with Ellis & Eaves draft and

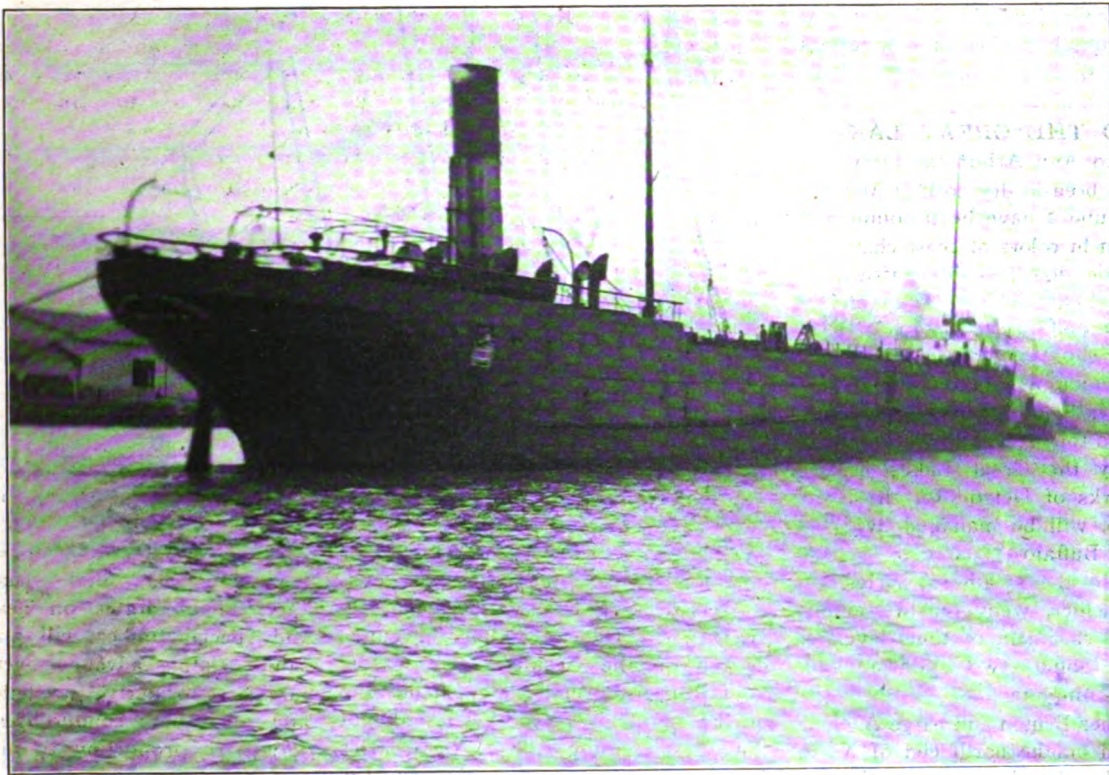
allowed a working pressure of 180 lbs.

Associated with this large order for steamers is the taking over of the plant of the Ship Owners Dry Dock Co., of Chicago, by the American Ship Building Co., the details having been arranged be-

known, but are believed to be somewhat less than a half million dollars. The Ship Owners Dry Dock Co. was owned by Moses Taylor and other interests associated with the Lackawanna Steamship Co., and will probably therefore represent part payment for the new steamers. The plant of the Ship Owners Dry Dock Co. is located on the north branch of the Chicago river at Halsted street, operating three dry docks, the largest of which is 480 ft. on the keel blocks. The taking over of this plant gives the American Ship Building Co. control of every ship yard and dry dock on Lake Michigan, with the exception of the plant of the Manitowoc Dry Dock Co.

STEAMER EDENBORN.

The steamer Wm. Edenborn, which is in No. 1 dry dock, Cleveland, will be there for the balance of the month. She was broken in two and will practically have to be rebuilt amidships. Her frames are twisted and bent where she rested on the rocks and a space about 35 ft. amidships will have to be entirely replaced. With the exception of this there is practically no other damage to be repaired though while she is in dry dock she will be generally strengthened throughout. When she comes out of the dry dock,



THE STEAMER EDENBORN ENTERING THE RIVER AT CLEVELAND, AFTER HER EXPERIENCE ON SPLIT ROCK, LAKE SUPERIOR. NOTE THE HUMP IN HER.

Building Co., whereby the company will build for the Lackawanna Steamship Co. eight freight steamers for 1907 delivery. The last steamer is promised for August

tween Mr. Moses Taylor of the Lackawanna Steel Co., of Buffalo, and Mr. J. C. Wallace in New York this week. The exact terms of the transfer are not

she will be as staunch as when she was launched. The accompanying photograph shows the hump in her caused by the break.

LAKE SHIP YARD METHODS OF STEEL SHIP CONSTRUCTION.

BY ROBERT CURR.

STERN BUILDING.

Fig. 64 shows the plating and cant frames on the sheer plan.

the same numbered lines on the half breadth plan, Fig. 68.

The buttock lines on the half breadth plan are two feet apart and parallel to the center line, which are shown by the numbers.

All the numbered lines on these two plans represent buttock lines with the

extreme after end of the deck at center.

From the line A C the buttock lines, 2, 4, 6, 8, 10, 12, 14 and 16 are measured square to the intersection of the deck line on Fig. 67 and transferred to Fig. 68 on the same lines as shown by the same numbers, giving the deck line as shown on half breadth plan, Fig. 68.

The same process is gone through for to get in the knuckle line on the half breadth plan.

E D represents the extreme after end of the knuckle line at center and by measuring from this line to where the buttock lines intersect the knuckles at side and transferring same to half breadth plan furnishes the knuckle line, as shown on Fig. 68.

By following up the numbered lines on the two plans the deck and knuckle lines will be plainly seen

SET LINES.

After the knuckle and deck lines have been faired up the set lines for the deck and knuckles are run in.

D F, Fig. 69, is the set line and is run in on the sheer plan at right angles to C D G. G is a continuation of

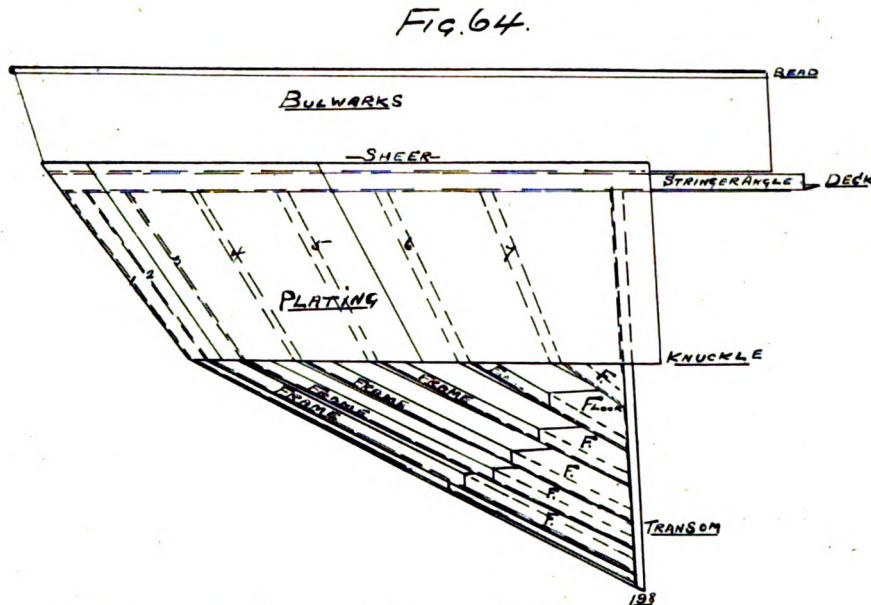


Fig. 65 shows the half breadth plan of the stern. The bulwarks are not on this plan, only the plating and cant frames.

Fig. 66 shows half plan of spar deck stringer around the stern. Numbers 1, 2, 3, 4, 5, 6 and 7 represent the cant frame beams.

Lines 2 B, 4 B, 6 B, 8 B, 10 B, 12 B, 14 B and 16 B represent the buttock lines. 198 represents the transom frame and the other numbers the frames before same.

DECK AND KNUCKLE LINES.

Fig. 67 shows the sheer plan and Fig. 68 the half breadth plan. These two plans show the method of getting the knuckle and deck lines as shown by following up the numbered lines.

The sheer plan, Fig. 67, is the first plan to be fixed. In this case the knuckle line is run in parallel to the deck on the sheer plan, Fig. 67, and all the buttock lines numbering 2, 4, 6, 8, 10, 12, 14 and 16 are ended on same. From the knuckle line the buttock lines are drawn in parallel to C D and intersect the deck at side, as shown by numbers 2, 4, 6, 8, 10, 12, 14 and 16 shown on Fig. 67. From the deck the lines are run down to the half breadth plan and where they cut the same numbered buttock line on the half breadth giving points for the deck line in plan.

The same process is gone through for the knuckle line as shown by lines running from the knuckle Fig. 67 to

exception of the frame lines 195, 196, 197 and 198.

The method of transferring the lines from plan 67 to 68 is done by erecting a perpendicular line from A to C, representing the deck line at the

the line C D. From D G at right angles the lines 2 to 18 are run to the knuckle intersecting the buttock lines on same and the measurements from D G to 2, 4, 6, 8, 10, 12, 14 and 16 are transferred to the half breadth plan,

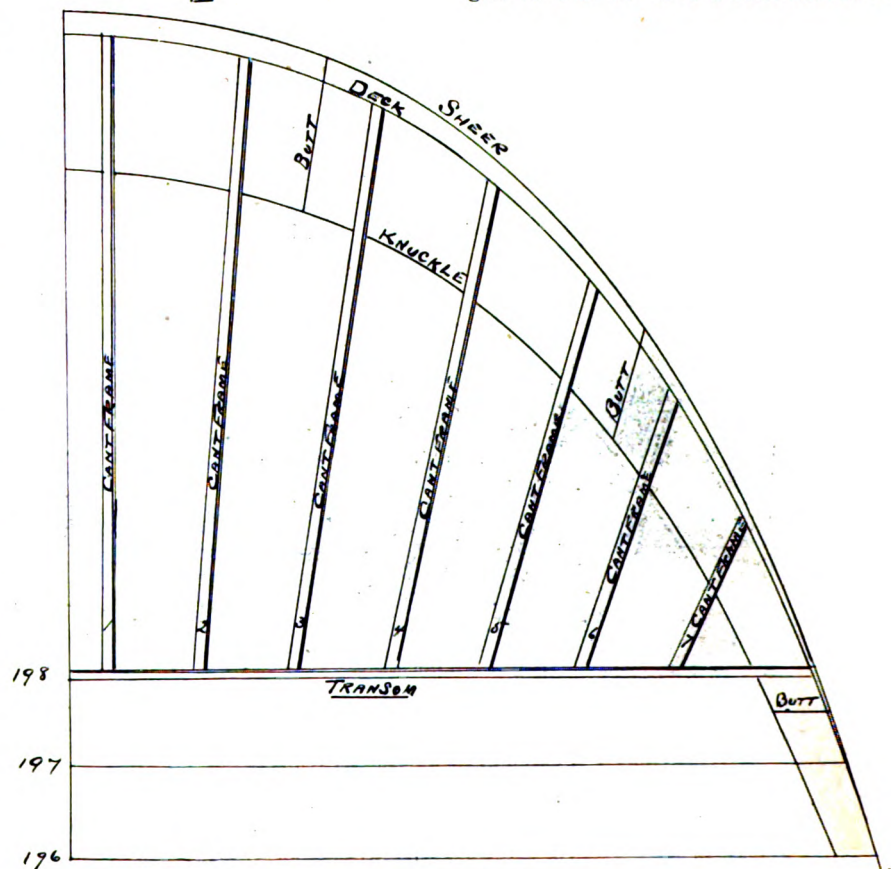


Fig. 65.

Fig. 70, measuring on the same numbered buttock lines from the perpendicular line E G D for the knuckle set line.

On the sheer plan, Fig. 69, the line D G is hinged from D on to E D, as shown by G G, and the lines shown perpendicular from Fig. 70 and numbered 2-2, 4-4, 6-6, 8-8, 10-10, 12-12,

HILL ORE LANDS SOLD.

Papers completing the transactions for the transfer of the Great Northern ore lands to the United States Steel Corporation were signed Oct. 5 in the offices of J. P. Morgan & Co. in New York. Judge E. H. Gary, James J. Hill, J. P. Morgan and a number of attorneys took part in the conference which concluded

mation of this agreement will result in great benefit to both parties."

The price named in the statement includes the cost of transportation to the docks on the upper lakes, and the terms of the lease guarantee to the Great Northern railroad the ore traffic from the mines. At present the carrying charges to the ports is 80 cent per ton, which leaves 85 cents for royalty on the ore mined. The Steel Corporation will have the added expense of mining, but this is expected to be low and to ensure a small cost per ton as compared with the present price of ore at the Duluth docks.

AMOUNT OF THE DEPOSITS.

The amount of ore in the Hill properties has been variously estimated. Mr. Hill himself has stated his belief to be that the properties do not contain less than 400,000,000 tons or more than 500,000,000 tons, but officials of the Steel Corporation are understood to estimate the deposits at about 300,000,000 tons, and this view coincides with that of other ore experts. If this assumption is correct, about 41 years will be required to exhaust the deposits, provided only the minimum amount required by the contract is mined, and the production of the mines would then be as follows:

For the first ten years:

1907	750,000
1908	1,500,000
1909	2,250,000
1910	3,000,000
1911	3,750,000
1912	4,500,000
1913	5,250,000
1914	6,000,000
1915	6,750,000
1916	7,500,000

Total 41,250,000
31 years at 8,250,000..... 255,750,000

Total 297,000,000

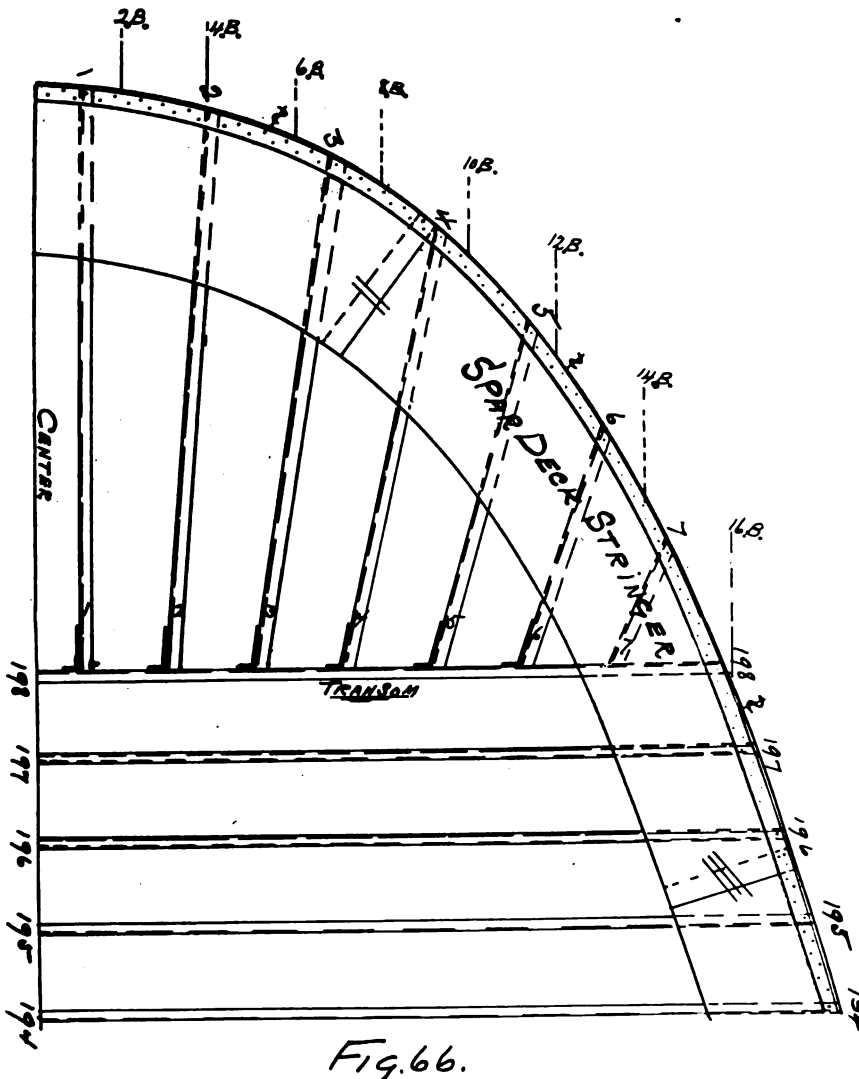
Up to the present time there has been no mining done at these properties, except the Leonard, which has produced as follows:

1903	10,591 tons
1904	151,952 tons
1905	297,011 tons

Total 459,554 tons

It is understood that the Longyear properties owned by Messrs. Hill and Longyear jointly are included, as are also some properties of the Northern Pacific railroad.

Capt. Claud Eunes, master of the steamer B. F. Jones, recently celebrated his thirty-fifth birthday anniversary while coming down Lake Superior from Duluth to Lake Erie. In honor of the occasion a seventeen-course dinner was served with a birthday cake on which thirty-five candles were burning as the "piece de resistance." Thomas Heffron, one of the well known marine stewards, was chef for the occasion.



14-14 and 16-16 represent the distance from the line C D G to where the knuckle is intersected and numbered.

The same process is gone through for the deck set line, which is erected at C as shown by C H. These set lines in the half breadth plan can be obtained by measuring along the line D F.

The steamer Joseph Sellwood, of the Mitchell fleet, ran on the east bank of the Lime Kiln crossing on Tuesday, sinking across the channel and blocking about two-thirds of it. At the same time that the accident occurred the anchor of the steamer Sahara scraped the Sellwood amidships and a few plates will have to come off.

the transactions. After the signatures had been duly affixed, Judge Gary gave out the following statement:

"After long negotiations, a contract has been signed for the acquisition on a royalty basis of the Hill ore properties (so-called) by companies controlled by the United States Steel Corporation. The quantity of ore has not been accurately determined, but it is a large body. The price to be paid is \$1.65 per ton delivered at the upper lake docks, with an increase of 3.4 cents per ton each succeeding year. The minimum agreed to be mined is 750,000 tons for the year 1907, and increases by 750,000 tons per year until it reaches 8,250,000 tons, and thereafter it continues on that basis. The lease is perpetual until the ore is exhausted. It is believed the consum-

ANNUAL MEETING AMERICAN SHIP.

The annual meeting of the American Ship Building Co. was held at Jersey City on Wednesday of this week. Mr. James C. Wallace, president, submitted to the stockholders the best report that the company has ever made, and at the same time announced the closing of contracts for eight steamers. The financial statement shows the company to be in stronger condition than ever. The surplus is \$5,098,168, in addition to which generous sums have been set aside, not only for depreciation and maintenance, but for special maintenance and rebuilding. During the year the company completed thirty steamers, and has already orders to construct forty-two for the next fiscal year. The company certainly was never in better condition than now. No change was made in officers or in the board of directors. They are as follows: W. L. Brown, chairman of the board; James C. Wallace, president; Russell C. Wetmore, vice president and treasurer; H. H. Porter Jr., Robert Wallace, H. M. Hanna, R. L. Ireland, Frank W. Hart, W. C. McMillan, J. A. McGean, L. M. Bowers, A. B. Wolvin, Andrew M. Joys, Edward Smith and Samuel Mather. O. J. Smith is secretary and assistant treasurer; Robert Logan, gen-

RESOURCES.	
Plants and property	\$15,838,041.61
Additions to plants	487,552.22
Material on hand (market value)	576,683.97
Accounts and bills receivable	3,279,247.90
Due us on construction contracts	2,284,277.44
Cash	1,179,001.54
	<u>\$23,644,804.68</u>
LIABILITIES.	
Capital stock, preferred	\$7,900,000.00
Capital stock, common	7,600,000.00
Accounts and bills payable	500,000.00
Reserve for maintenance	103,932.03
Reserve for fire insurance	603,932.03
Earnings	<u>\$2,443,217.04</u>
Less:	
Dividend, preferred	\$ 553,000.00
Depreciation and maintenance	421,285.61
Rebuilding docks, etc.	85,559.07
Reserve for maintenance	300,000.00
	<u>1,359,844.68</u>
Balance June 30, 1905	\$4,318,792.65
Less common dividend, 4 per cent	304,000.00
	<u>4,014,792.65</u>
Working capital, June 30, 1906	5,098,165.01
	<u>\$23,644,804.68</u>

eral manager, and James H. Hoyt, general counsel.

The report is as follows:

"The past year has been the most successful one the company has had since its organization. This is due to the fact, in part, that the tonnage on the lakes is increasing in size, and also to the general prosperity that the country is enjoying.

CAPITAL STOCK.

Remains unchanged from last year, viz:

AUTHORIZED:	
Preferred	\$15,000,000
Common	15,000,000
Total	<u>\$30,000,000</u>

ISSUED:	
Preferred	\$ 7,900,000
Common	7,600,000
Total	<u>\$15,500,000</u>

DIVIDENDS.

Regularly quarterly dividends of one and three-quarters per cent have been paid on the preferred stock; and regularly quarterly dividends of one per cent have been paid on the common stock.

PROPERTY OWNED AND CONTROLLED.

CLEVELAND, OHIO.

Construction Yard, Boiler Shops,
Machine Shops, Three Dry Docks,
Foundry.

LORAIN, OHIO.

Construction Yard, Machine Shop,
One Dry Dock, One Dry Dock
(under construction.)

DETROIT, MICH.

Machine Shops, Brass Works,
Boiler Shops, Three Dry Docks,
Foundry.

WYANDOTTE, MICH.

Construction Yard, Machine Shops,

SUPERIOR, WIS.

Construction Yard, Machine Shop,
Two Dry Docks.

CHICAGO, ILL.

Construction Yard, Machine Shop,
One Dry Dock.

MILWAUKEE, WIS.

Machine Shop, Two Dry Docks.

BUFFALO, N. Y.

Construction Yard, Machine Shop,
Four Dry Docks.

WEST BAY CITY, MICH.

Construction Yard, Machine Shop.

VESSELS BUILT.

Plants.	Vessels Built.	Carrying Capacity Net Tons.
Superior	3	31,000
Lorain	7	60,500
Cleveland	7	40,500
Detroit	6	47,000
Chicago	3	33,000
Bay City	4	40,500

TOTAL.

Vessels Built..... 30
Carrying capacity, net tons..... 261,500
(Carrying capacity is based on 19 ft. draught.)

SUMMARY AND PROSPECTS.

As stated above, the company has built and completed thirty vessels during its past fiscal year, of an average carrying capacity of over 8,700 tons each, and now has under contract forty-two vessels, that will have an average carrying capacity of about 9,200 tons each. By this comparison it will be seen that the average carrying capacity is increasing each year. One of these vessels will be the largest and most magnificent side wheel passenger steamer ever built for fresh water service in the world. One is a car ferry, and the others are all bulk freight carriers.

Your president desires to take this occasion to thank the officers of the company, directors and stockholders for their continued hearty co-operation and most efficient support.

The condensed balance sheet herewith shows the condition of the company.

Respectfully submitted,

W. L. BROWN, JAMES C. WALLACE,
Chairman of the Board. President.

CONDITION OF THE PROPERTY.

The conditions on the great lakes have been changing so during the past two or three years, especially in the annually increasing tonnage, that it has been deemed advisable to provide in the near future for larger dry docks to accommodate the greater number of larger vessels that are in commission and will go in commission shortly.

The new dry dock and other improvements started last year at the Lorain plant will be in operation by December first, next.

There has been purchased additional real estate at the Detroit Ship Building Co.'s plant, at the foot of Orleans

The general board met in Washington on Wednesday. Through the hasty sending of warships to Cuba, the entire naval program for the year has been altered. Target practice at Provincetown has been much interfered with by the movement of war ships to the southward, and the uncertainty caused by the Cuban situation makes it impossible for the navy to frame definite plans for the future. Consequently, the general board has many subjects to consider, and frequent sessions will doubtless be necessary pending the settlement of the difficulty in Cuba.

AT HEAD OF LAKES.

Duluth, Oct. 9, 1906.—The shipment of ore from Mesabi and Vermillion range ports fell off materially during the past week. Throughout the week there was a scarcity of boats at upper lake docks, due largely to delays at Lake Erie ports in unloading and in loading coal. At the end of the week, however, a considerable number of coal cargoes were waiting at this end to unload and several boats were five and six days unloading. Some of the coal docks were empty at the same time, however, that two or three boats were lined up waiting for another dock. It would seem that quite a saving could be accomplished by an agreement between docks whereby a dock that was open could be used by another that was crowded especially where the same kind of coal is handled at both places. The receipts of coal this year have been over a million tons in excess of the shipment at this time last year, but on the other hand stocks at this end are lower than last year, because of the large increase in demand. At Port Arthur and Fort William the quantity of coal in sight before the close of navigation promises a stringency in the supply during the winter, but it seems impossible to forward it any faster. At both ends of the route the output of the mines has had to be checked to accommodate it to the supply of boats and cars. The ore mines during the past week were for a couple of days when boats were particularly scarce shipping practically nothing, and the coal mines have been in a somewhat similar position.

The figures showing the ore shipments indicate a large increase over last year, despite the lessened activity, much of which gain was made during the last two days of the week. The figures are: Two Harbors, 225,035 tons; Duluth, 350,088 tons, and Superior, 179,644 tons, a total of 754,067, or 104,308 tons less than the same week in September. During the same week last year the shipments were: Two Harbors, 231,480 tons; Duluth, 258,329 tons, and Superior, 164,977 tons, an aggregate of 654,786 tons. The gain during the week over last year was 99,281 tons. The total shipment for 1906 from these three ports is 19,743,162 tons, against 17,318,171 tons last year, an increase of 2,424,991 tons.

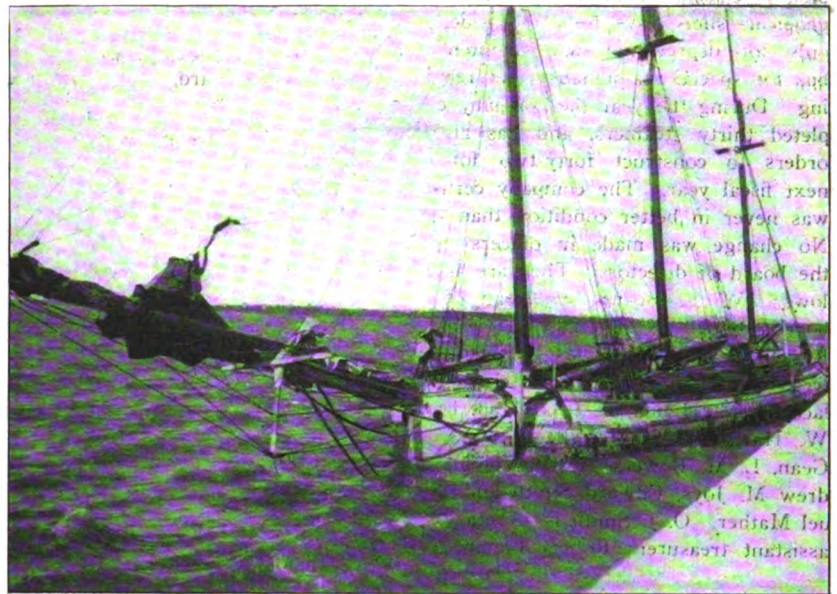
In connection with the leasing of the Great Northern ore land to the United States Steel Corporation many predictions of tremendous shipments next year have been made. There is no real reason for this. A bigger factor in the increasing of shipments next year than the ore deal will be the new docks at Duluth and Superior and the added boat tonnage. The increase resulting directly

from the recent transfer will pass over the Allouez docks entirely, will amount only to approximately 12½ per cent of the docks' total shipment, and will add less to the ore movement than the opening up of some individual mines have. It will mean that about 150 more boats of the Steel Corporation line will load at Superior than have in the past, a fact which in the matter of dispatch will be a considerable advantage as the Allouez docks have been considered with the

which is the normal amount. Predictions are that one-third less grain will be shipped as the result of the inadequacy of the railroad.

WRECK OF ADA MEDORA.

In attempting to enter Buffalo harbor in the gale of Oct. 6, the lumber laden schooner Ada Medora ran on the north breakwater, the impact causing her seams to open and the vessel to fill with water. The crew escaped to the break-



THE BARGE ADA MEDORA ON THE BREAKWATER AT BUFFALO.

docks at Ashland and Two Harbors as the fastest on the lakes.

The grain rate continues at 2¾ cents from Duluth, with slightly declining receipts during the first week of the month. For September the total receipts and shipments were close to a million bushels in excess of the figures last year. For the week ending October 7, 1906, the receipts were 4,124,467 bushels and the shipments 3,359,394 bushels. Compared with this statement the receipts and shipments for the same week last year show that 4,184,954 bushels were handled in and 4,181,701 bushels handled out. The comparative statement for the past two weeks is as follows, showing that the stocks at the head of the lakes continue to increase:

	Receipts.		Shipments.	
	Sept. 29.	Oct. 7.	Sept. 29.	Oct. 7.
Wheat	2,842,741	2,701,151	1,825,317	2,250,277
Corn	9,830	7,137		
Oats	187,645	264,570	173,493	18,830
Barley	583,060	574,507	578,802	368,349
Rye	27,801	22,371		61,105
Flaxseed	444,995	554,731	247,289	660,883

A serious congestion exists at Fort William in the matter of moving grain cars. Delays all along the Canadian Pacific between Winnipeg and the Canadian head of the lakes have been augmented so that the condition is practically one of a grain blockade. Only about 150 cars a day are being moved instead of 300

water and were afterwards taken off by the life savers. Shortly after the accompanying photograph was taken, the Medora was pounded to pieces and is now sunk with only her spars visible.

RECORD FOR GRAIN CARGO.

The steamer B. F. Jones loaded 370,273 bushels of Duram wheat at Duluth Tuesday noon. It was shipped by the Ames Brooks Co., D. T. Helm & Co., agents, at 2¾ cents. This is the lake record for a grain cargo.

TRADE NOTE.

C. Lee Cook Manufacturing Co., Louisville, Ky., has recently put out an excellent little catalog for Cook's metallic packing for steam, gas or air. The catalog contains a complete description of metallic packing manufactured by this company. The catalog is well illustrated with fine wash drawings. In the rear pages of the catalog are given a list of concerns that are using this packing. Among the concerns using it on the lakes are the Detroit, Belle Isle & Windsor Ferry Co., Detroit, and the Great Lakes Dredge & Dock Co., Chicago.

SCIENTIFIC LAKE NAVIGATION

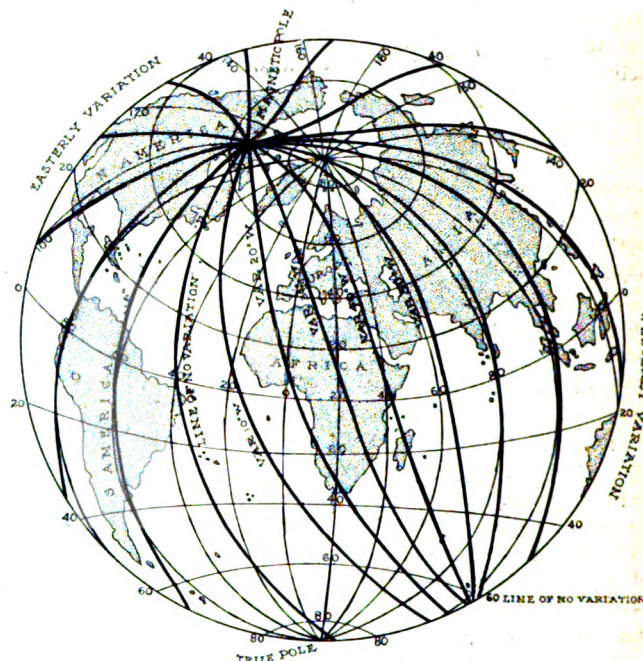
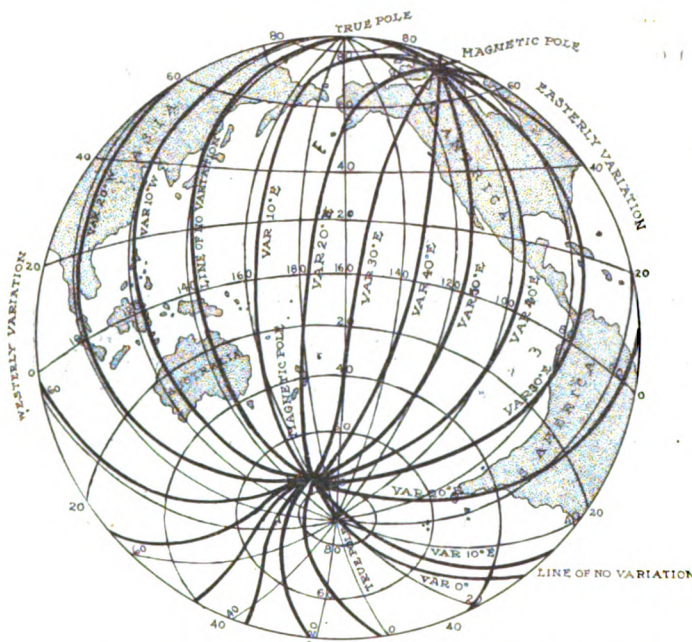
By Clarence E. Long

ANNOUNCEMENT.

IT IS SUGGESTED THAT MASTERS AND MATES, WHEELSMEN AND WATCHMEN AND OILERS AND WATERTENDERS WHO ARE COMPETING IN THE QUESTION COURSES NOW RUNNING IN THE MARINE REVIEW, KEEP DUPLICATES OF LIST OF THEIR ANSWERS. AS THE COURSE WILL RUN FOR SEVERAL MONTHS YET, COMPETITORS MAY, IF THEY DISCOVER THAT THEY HAVE

It is impossible to obtain a magnet with only one pole. If a magnetized needle is broken into a number of small pieces, each little piece is a magnet having a north-seeking and a south-seeking pole. Hence it would appear that every particle of a magnetized body is a little magnet, all having their south-seeking poles set in one

bismuth, antimony, copper, silver, gold, lead, sulphur, phosphorus, and water, are not only not attracted by a magnet, but are actually repelled; these are said to be diamagnetic. When a magnet substance is brought near to or in contact with a magnet, it becomes converted into a magnet by magnetic induction, just as a



The two illustrations above show the relation of the magnetic and true poles of the earth and the isogonic lines, or lines of equal variation, with the true meridians. The heavy, irregular lines converging to and passing through the magnetic poles, are the equal lines of variation, technically known as isogonic lines. They are in one sense nothing more than magnetic meridians, for each line or curve indicates that along any such line the variation needle is of the same amount. Isogonic lines, or lines of equal variation, do not indicate by their direction the direction of a freely swinging magnetic needle under the influence of terrestrial magnetism only. For this reason this system of indicating the variation needle is ill adapted to carry a distinct view of the phenomena in themselves, or to exhibit their physical relations. To the beginner these lines are not only confusing but misleading, unless he first thoroughly understands the principle and meaning of such a line. The trouble lies in getting the direction of the line as the direction of the needle, instead of the line indicating that the variation is of the same amount all along the same line, or for all locations situated on such a line. There is no telling how much the variation is by the direction of an isogonic line; each line must have the amount inscribed alongside of it, such as 10° E, 20° W, etc., before anything can be told about it.

The isogonic lines, or lines of equal variation, in the above illustrations are not a true representation of the real isogonic lines of the earth, they merely show the principle of the system of marking the variation where it is of the same amount; they also show how irregular the variation of the compass is compared with the true directions; how the variation can be the same at certain places and of different amounts at other places, also the manner in which the magnetic needle points to the magnetic poles of the earth and not to the true poles; why the variation is easterly at some portions of the earth and westerly at other portions. It is easily noted that when the observer is so situated on the earth's surface as to bring the north magnetic pole to the right of the true north pole the variation is easterly (see first illustration), and when in such a position as to bring the north magnetic pole to the left of the true north pole, the variation is westerly. Also, when in such a position as to bring both the true and magnetic north poles in transit with each other, the variation is nothing.

While these illustrations do not accurately show the system of isogonic lines as they are on the earth's surface, they, nevertheless, afford the student a correct and distinct view of all the phenomena connected with the system called isogonics.

The system of isogonic lines connecting the north and south magnetic poles with almost the same regularity as the geographical meridians converge to the geographical poles is not a fact. We have made them so in order to simplify matters, in connection with the study. As a matter of fact there is absolutely no intersection of the isogonic lines at these poles from points at any considerable distance. True, they converge to the magnetic poles, but they do not intersect, the nearest intersection being about 200 miles and the farthest about 2,000 miles away. Since all compass action ceases near the magnetic poles the impossibility of tracing such lines to the poles. Between the magnetic pole and true north pole next to

ANSWERED INCORRECTLY, SEND IN ADDITIONAL ANSWERS. BY KEEPING A DUPLICATE LIST OF ANSWERS, THEY WILL KNOW WHAT THEIR FIRST ANSWER WAS. THIS SUGGESTION IS MADE BECAUSE IT IS NATURAL THAT STUDENTS WHO ARE FOLLOWING MR. LONG'S LESSONS MAY FIND THAT QUESTIONS ANSWERED BY THEM SOME MONTHS PREVIOUSLY HAD BEEN ANSWERED INCORRECTLY. SUBSCRIBERS SHOULD ALSO UNDERSTAND THAT MR. LONG IS ANXIOUS AT ALL TIMES TO ASSIST THEM EITHER PERSONALLY OR THROUGH THE PAPER, IF AT ANY TIME ANY PHASE OF THE LESSON IS NOT CLEAR TO THEM.

direction, and their north-seeking poles in the opposite direction. Therefore, one face of the broken magnet must be positive, and the other negative, or magnetically opposite.

Bodies may be divided into two classes: viz., magnetic bodies, which are attracted by magnets, and non-magnetic bodies, which are not attracted. The most magnetic bodies are the metals, iron, nickel and cobalt. Some other metals, salts of iron, and of other metals, porcelain, paper, oxygen gas and ozone, are feebly magnetic. Other substances, as, for example,

change is induced in a conductor by an electrified body. The nearest pole thus induced is a dissimilar pole to the inducing pole, and the attraction of the magnet is thus due to the action already described of two dissimilar poles. When the inducing magnet is removed, most substances lose their magnetism, and hence are said to be temporarily magnetic; the perfection of this property in soft iron is of great importance to magneto-electric and dynamo-electric machines, which depend entirely for their effects upon rapid reversals of magnetic polarity.

Steel and nickel retain the greater part of the induced magnetism, and are said to be permanently magnetic. Cast iron also retains a large proportion of the magnetism imparted to it. Even so-called permanent magnets, however, lose a portion of their power gradually; but by "closing" their poles with pieces of soft iron, which thus become induced magnets with dissimilar poles in contact, the inducing effect of these pieces strengthens the magnetism; such pieces of iron are termed armatures. If magnetized steel is heated to redness, or is subject to violent blows, it loses its magnetism. That a magnetic needle points approximately north and south is due to the fact that the earth itself is a huge magnet, whose conditions accordingly relate to what is called terrestrial magnetism. Thus, the north magnetic pole is not at present identical with the true north pole, but is situated within the Arctic circle. In consequence of the different positions of the magnetic pole and the geographical north pole, a magnetic needle does not point true north and south, but a little to the right and left, according to the locality. This is termed the declination of the needle, and on the great lakes varies from 8° easterly to 10° westerly. The amount of declination varies from year to year, and in this country is at present diminishing at the rate of about $6'$ per annum. When a needle is balanced on a horizontal axle, so that it can turn in a vertical plane, and is then magnetized, it is found to set itself at an angle depending on the locality, with the north-seeking pole pointing downwards if north of the magnetic equator, and the south-seeking pole pointing downwards if south of the magnetic equator. This is termed the inclination, or dip of the needle, and a needle, thus arranged is termed a dipping needle. The amount of the dip varies in different places. Magnetic charts are maps on which are marked lines showing the distribution of the earth's magnetism. It is found that the three magnetic elements, as the declination, dip, and intensity of magnetic force are termed, vary not only in different places, but also in the same place, from year to year, from month to month, and even from hour to hour. Those changes which proceed gradually for several years are termed secular. Frequently disturbances occur which produce a temporary irregular effect on all the needles over a considerable area; these are termed magnetic storms, and are often connected

with manifestation of electrical phenomena, such as the aurora borealis, or a violent thunderstorm, and still more generally with those solar outbursts known as spots on the sun. All such changes in the earth's magnetism are now daily recorded at many stations by self-registering apparatus.

In the vibration experiments the amplitude of arc by which the needle is drawn aside should be as small as possible, consistent with accurately noting the last of the vibrations across the starting point, which should allow the needle to pass two or three divisions beyond, in order to be sharply defined. The same amplitude should be used for each set of vibrations.

Other methods of marking or naming the poles of a magnet are as follows: The north pole is called the positive or plus pole, marked thus, +; and the south pole, the negative or minus pole, marked thus, —

SOME MORE GOOD EXPERIMENTS.

For purposes of discussion, a theoretical magnet is assumed, long and indefinitely thin and uniformly magnetized. Such a magnet may be looked upon as a pair of poles united by a bar exerting no action, the whole magnetic effect being concentrated at the poles. When it is freely suspended, the line that joins the poles is called the magnetic axis, or the equator of the magnet.

The force exerted at different distances between the poles of the same magnetic mass is inversely proportional to the squares of the distances.

The force exerted at a given distance between two poles is directly proportional to the product of the magnetic masses of the poles.

With a given field, iron receives the greatest amount of magnetization, steel coming next. When the magnetization ceases to increase, the substance is said to be saturated.

The magnetic field is the space surrounding a magnet in which such magnet exercises its influence, and uniformity supposes the lines of force to be parallel.

Magnetize a piece of watch-spring about six inches long, and ascertain how large a nail it will support. Bring the two ends of the magnet into contact. The ring thus formed manifests no polarity, thus showing the equality of the opposite poles. Break the magnet at its middle, and test the strength of magnetization of the two new poles developed at the point of fracture.

Nearly fill a slender glass tube with

steel filings, and close the ends of the tube with corks. Draw the marked pole of a strong magnet from the middle of the tube to one end, and the unmarked pole from the middle to the other end, and repeat the stroking several times. One end of the tube will attract and the other will repel the marked pole of a suspended magnetic needle; that is, the filled tube has become a magnet. Thoroughly shake up the filings; the tube loses its magnetic properties, as if the actions of the many little magnets in the tube were neutralized through their indiscriminate arrangement.

When a magnet is broken each piece becomes a magnet, the newly developed pole being of strength nearly equal to that of the original poles. The subdivision of the magnet may be carried on indefinitely and with the same results. This suggests that the magnetic property must reside in the smallest particle capable of existing by itself, that is, the molecule. It is easy to imagine that if the steel particles in the shaken tube could be restored to their former positions, the tube would again act as a magnet. It may be assumed that the molecules of a magnetic substance do not exhibit magnetic properties when the magnetic axes of the molecules are turned indifferently in every direction; and that the process of magnetization consists in turning the molecules so that their axes point in the same direction. When the axes of all the molecules have thus been set parallel, the maximum of magnetization has been secured.

Magnetization changes the length, but not the volume of the bar magnetized. When soft iron is rapidly magnetized and demagnetized, it becomes heated, and sometimes a clicking sound is produced at each change.

Take a bar of very soft iron, about three feet long, and make sure by trial that its ends will not attract bits of soft iron. Then hold the bar in the plane of the magnetic meridian, as nearly as you can tell, and with its north end depressed below the horizon a number of degrees greater than the corresponding latitude of the place of experiment, that is, giving it the position of a dipping needle. Tap the rod on its end with a mallet or wooden block, and test it for magnetic polarity. The end towards the earth, in our latitude, would have north magnetism, and will attract the south end of a suspended needle. It will also support small bits of iron.

A magnetic field is recognized by the fact that it gives a definite direc-

tion to a magnet freely suspended in it. The directive tendency of the compass, and other phenomena show that the earth is surrounded by such a field. In fact, these phenomena are such as might be expected if we knew that a bar magnet four or five thousands miles long, extended nearly north and south through the earth's center. This terrestrial magnetism is explained as being due to equatorial electric currents produced by the action of the sun, and modified by the motion of the earth.

By observations of the north star, or in any other convenient way, mark a true north and south line on your experimental table, or on the floor where it will remain stationary. Place a magnetic needle in this line, and determine the direction and magnitude of the variation of the compass for your position. To verify the correctness of your work compare the variation determined by that given on a navigational chart of your locality; that given in the lighthouse book, or that given on an isogonic chart of the world.

Float a magnet on water as already explained. The float should be the lightest that will carry the load with safety, and the body of water should be so large that surface tension will not urge the float toward the side of the vessel which should be a wooden basin, or other non-magnetic substance. When the magnet is at rest near the middle of the liquid surface, determine the tendency of the magnet to drift toward the north or south. Repeat the experiment with a variety of magnets, and try to find one that always floats in one direction, that is, one in which the marked pole is stronger or weaker than the other. If you cannot find such a magnet, strongly magnetize the blade of an old hacksaw, and test it on the float. If you have not yet found that for which you seek, break the blade in the middle, and test each half. If necessary to the success of your search, break one of the halves in two, and repeat the tests. Make very careful notes of any magnet that you find to have more magnetism of one kind than of the other. Such a magnet would not do for a compass needle, neither would it do for the purpose of adjusting the compass. It will be more difficult to find unequal poles of the same magnet among smaller magnets than it will larger ones.

Were it possible to get a magnet with only one pole, say a north pole, for instance, under the above conditions, it would move on toward the north as far as the basin would permit

it. The attractive effects being due to terrestrial magnetism. Some people have an idea that, under the above conditions, the magnet ought to float towards the north just the same. This is because they entertain the idea that the north end of the needle contains all the magnetism, and the south end none. The earth's magnetism, which gives the needle directive power, is, we might say, stationary; because a compass needle (which is simply a bar magnet) always arranges itself in a north and south line, this result is the same as if the earth were an immense magnet, with one pole at the north, and the other at the south. Hence, the theory is, that the earth is really a magnet, and the magnetic force of the earth compels the compass needle to take this position.

As the compass needle has two ends, and one in pointing north must cause the other to point south.

The terrestrial globe exhibits the properties of a magnet in the directing power it exerts upon the magnetic needle. Whether on sea or land, on mountains or in deep valleys, a magnetic needle, if free to move, always so adjusts itself that its poles point in a definite direction, along a line which is near to north and south true or geographically.

That pole of the needle which is attracted by the north magnetic pole of the earth, must be in an opposite magnetic condition. Hence it is the proper south pole of the magnet, but since it points toward north, it is designated the north pole.

MAGNETIZATION.

The various sources of magnetism are the influence of natural or artificial magnets, terrestrial magnetism, and electricity. The three principal methods of magnetization by the inductive action of permanent magnets are known by the technical names of single touch, separate touch and double touch.

MAGNETIZATION BY THE ELECTRIC CURRENT.

Much greater power can, however, be obtained by means of electro-magnetism; and the following methods are now almost exclusively employed by the makers of magnets.

A fixed electro-magnet is employed, and the bar to be magnetized is drawn in opposite directions over its two poles. Each stroke tends to develop at the end of the bar at which the motion ceases the opposite magnetism to that of the pole which is in contact with it. Hence strokes in opposite directions over the two contrary poles tend to magnetize the bar the same way.

When very intense magnetization is to be produced the electro-magnet must be very powerful, and the bar then adheres to it so strongly that the operation above described becomes difficult of execution, besides scratching the bar. Hence it is more convenient to move along the bar a coil of wire through which a current is passing.

DESTRUCTION OF MAGNETISM.

The capability of induction, and the correlative power of retaining the induced magnetism, as we have seen, are both greatly affected by any mechanical or other force which excites a vibratory motion in the particles of the iron. On the other hand, the magnetism of a steel bar is weakened, or even wholly destroyed by the same means; the vibratory motion which is imparted to the molecules of the body favoring the recombination of the separated magnetism, and, therefore, the return of the body to the neutral state. It is thus that the power of a magnet is seriously lessened, or altogether destroyed, by a fall from a height upon a hard pavement.

INDUCED MAGNETISM.

All soft or cast iron rods or bars, or other elongated forms of cast or soft iron, unless the position of their length is at right angle to the line of the direction of the earth's magnetic force, are immediately rendered magnetic by induction from the earth, and the nearer the iron is to the line of force or dip the greater will be the amount of induction. When a bar of soft iron is held on the magnetic meridian and parallel to the dip it becomes immediately endowed with feeble magnetic polarity. The lower extremity is an N (red) pole, and if the N (red) pole of a small magnetic needle be approached to it it will be repelled. If the bar is held vertically the lower end will still be a north pole, but of less intensity. If the bar is held horizontally north and south the north end will be a north pole but of still lesser intensity, the south end of a south pole also of lesser intensity. If we now turn the bar in the same horizontal plane its magnetism will diminish, and if placed in an east and west direction it will lose its polarity, and if we turn it still further, until its position is reversed, the magnetic poles of the bar will be reversed.

Magnetism resulting from induction may be more or less permanent, or totally transient. Thus it has been found that a bar of iron that has remained fixed for a long period in a direction parallel, or nearly so, to the earth's line of force becomes a per-

manent magnet. If, however, the bar be of hardened steel its magnetism will require a little time to arrive at its maximum intensity of magnetization, because of the coercive force causing it for a short time to resist magnetization.

Since the effect of inducing action is much increased by mechanical concussion, or any other cause which imparts molecular vibration to the bar while under the action of the inducing force, hence, to magnetize an iron bar we have only to hold it in the direction of the earth's magnetic force, and to strike it on the end while so held with a hammer. The bar will be found to acquire by this simple process a considerable amount of magnetism. As the direction of the earth's magnetic force in higher latitudes is not far from the vertical the effect produced will be nearly the same if the bar be held vertically. The end of the bar which was lowest being charged with north, or red, polarity; and this magnetism is not transient like the induced magnetism of soft iron, changing its place in the bar with every change in the position of the bar, but is constant like that of a steel bar, retaining the same magnetism whatever the position of the bar. By reversing the position of the bar and striking it a few blows with a hammer, its magnetism is reversed. The magnetism of the bar so struck resembles that of a magnet in all respects but this, that while, perhaps no change can be remarked in hours or days, it infallibly diminishes in a long time. To express this partially permanent character the term subpermanent magnetism has been adopted.

PERMANENT MAGNETISM.

You have noticed when soft iron is removed out of the magnetic field it is no longer a magnet. A piece of hard steel, such as a knife blade, file, etc., retains its magnetism when removed out of the magnetic field. Such a magnet is called a permanent magnet. Shocks, such as concussion, hammering, etc., have both the effect of producing and destroying magnetism. If the body is highly magnetized the effect of concussion is to destroy magnetism, if not magnetized the effect is to increase magnetism.

Another very peculiar thing about magnetism is in the construction of ships of iron and steel. The quality of the iron or steel in each individual plate may be such that it would not retain magnetism when by itself and would act the same as an ordinary bar of soft iron, but when these plates are riveted together in the shape of a

vessel it was found that the hammering, twisting and bending converted them into permanent magnets, the total effect of which on the ship's compass is very large and very irregular. It was found by theory, and confirmed by experiment, that the total permanent magnetism could always be resolved into two magnets, one along the ship's length, and the other athwartships of the ship. This is the reason for employing two magnets in the adjustment of a compass.

After a few voyages of an iron ship a considerable amount of magnetism obtained during construction is lost. This is due to being over-saturated with the magnetic fluid, the same as a magnet when it is first magnetized. Vibration, friction, heat, cold, buffeting the waves, change of geographical position, etc., etc., have each a part to play in the ship's magnetism taken as a whole. After a number of years the ship acquires more of a permanent magnetic condition, but in no case is it such that it can be depended upon from year to year.

A FEW DEFINITIONS.

Magnetic Points of Consequence. The points (really the magnetic poles of the earth) which occupy the center of lines of equal dip.

Points of Magnetic Indifference. A point near the center of a magnet where no effect is produced.

Magnetic Curves. A series of lines or directions which may be graphically denoted by iron filings scattered upon a card or pane of glass placed horizontally upon a magnet and gently tapped. The beautiful lines into which the filings are thrown indicating lines of magnetic force.

Magnetic Elements. Intensity, declination and dip.

Magnetic Intensity. The greater or less effect by a magnet, usually measured by its attractive force. This varies inversely as the square of the distance.

Magnetic Limit. A limit of temperature beyond which iron or any other magnetic metal ceases to be affected by the magnet.

Magnetic Needle. A slender poised bar or plate of magnetized steel. The needle suspended by a metallic or jeweled center upon a hardened steel pivot. For other instruments needles are often suspended by fine silk thread or even spider-lines. The test of delicacy is the number of horizontal vibrations which the suspended needle will make before coming to rest.

Magnetic North. That point of the

horizon indicated by the direction of the magnetic needle.

Magnetic Saturation. The state of a bar or needle when it has received the greatest amount of magnetic force which can be permanently imparted to it.

Magnetic Storms. Magnetic disturbances felt simultaneously at places remote from each other.

Saturation Point. Every magnet when first made will lose a certain amount of its magnetism, and finally settles to a permanent state called saturation point.

Magnetic Metal. Any metal, such as iron, steel, tin, zinc, nickel, cobalt, etc., which may receive the properties of the magnet.

Magnetic Screen. A shell of soft iron cutting off a magnetic needle from the influence of a magnet.

Magnetic Shield. A hollow iron case in which a watch is permanently kept to screen it from derangement by extreme magnetism.

Magnetism was known to the ancients, having been first observed in the loadstone, a species of iron ore found in abundance near the city of Magnesia, in Asia Minor, whence the magnet takes its name.

Magnetic Tick. A faint click heard when a substance is magnetized or demagnetized. Called also magnetic click.

A MYTHICAL VOYAGE.

Starting from the north magnetic pole one would have to steer due south by compass to reach the true or geographical north pole, since the compass needle points not to the true pole but to the magnetic pole. This does not look reasonable at first thought, but it is nevertheless a truth. To prove it try the following experiment. Lay a bar magnet on a table, flat side down, and lengthwise from you, with its south end or pole, from you, thus representing the earth's magnetism as it really exists. Now, take a small magnetic needle suspended from a thread, and starting from the center (equator) of the bar magnet carry it along the top of the bar magnet (be careful and not hold it too close to prevent dip and possible repulsion instead of attraction, but just far enough away so that its influence will be gently exerted, though manifestly traceable) moving towards the north pole representing the earth's magnetism (away from you). It will be seen that the north end of the suspended needle will remain parallel with and its north end pointing in the direction of the bar magnet containing south magnetism, just as though

the terrestrial magnetism influenced it. Now, carry the suspended needle a little beyond the end of the bar magnet (toward the true pole as it were), and it will be found to turn completely round (180°) and point in the reverse direction, that is, that end of the needle points constantly to that pole of the magnet, and will continue to so long as it is held within the influence of the bar magnet. This is the precise manner in which the earth's magnetism operates on the compass used for navigating purposes.

The variation of the compass, then, when the observer is directly between the magnetic and true poles, as in the above example, would be 180° , the greatest amount of variation possible.

Captain Ross discovered the approximate positions of the magnetic poles by means of the dipping needle, and his experience was identical with the above experiment.

To reach the true north pole of the earth, if it were possible, from the magnetic north pole we would have to steer due south by compass—from the south magnetic pole to the true south pole due north by compass.

THE ABSURDITY OF ATTEMPTING TO INSULATE THE COMPASS FROM THE MAGNETISM OF THE SHIP.

Towson says that in connection with compass deviations, many practical men have vainly attempted to discover some substance or medium that would insulate the needle from the influence of the magnetism of the ship's iron. Many imagined discoveries of this character have been patented, and have served both to waste the time and money of the patentees and to distract the attention of the mariner from that class of study which alone can promote his safety in navigating his ship. It may be stated with confidence that there is no available medium that can intercept magnet influence. For two centuries, at least, every class of bodies has been submitted to experiment, in order to discover a material capable of intercepting the influence of one magnet on the other, not for the purpose of preventing deviation, but because the mechanic clearly perceives that if such a material were discovered a motive power could be produced by various arrangements of permanent magnets and insulating bodies. But no one has succeeded in making the discovery. Should, however, the efforts, which for two centuries have been unsuccessful, be realized, although a new motive would be available, it would be altogether valueless in connection with compasses of ships. The mag-

netism of the earth generally, the loadstone, soft iron, hard steel, or the electro-magnet, is of the same nature. If we shut off one we shut off all.

If, therefore, we could succeed in insulating the needle from the magnetism of the ship we could by the same means intercept the magnetism of the earth, and thus the compass would be rendered absolutely useless. In the first place, then, the object sought for is not obtainable; and, secondly, if such a medium did exist, it would be entirely valueless in connection with the compasses of ships.

HOW TO TELL A GOOD COMPASS.

A simple test for a compass is to place it in position, noting the reading thereof, and with a pocket-knife, or piece of steel, deflect the needle, remove the attraction quickly, and the time it takes to come to rest at the exact point it started from. If the card is very slow in coming to rest, or does not return to the exact point it started from, something is wrong with the compass. Either the magnets are weak, the weight too great on the point of support, causing friction, or the jewel cap may be defective. In purchasing a compass always give it this test. Remember, the compass that will show the quickest number of vibrations in a given number of seconds is the best instrument for any and all purposes.

INVENTORY OF THE COMPASS.

In the navy, blank forms are furnished for recording in detail all the information in regard to sensibility, directive force and general condition of each compass on board.

Instructions on the back of each form or report, explain the method of making the necessary observations, and require that the form shall be filled out and sent to the bureau of equipment in January of each year.

The test for sensibility is to take the reading of the compass before disturbed, and again after it comes to rest. If there be any difference in the two readings it shows the sensibility to be poor. The card is deflected to the right and to the left of the point of rest.

The test for directive force is similar to the test for sensibility. This is performed by the method of time vibrations; that is, the reading of the compass is noted when at rest, and then made to vibrate to the right and to the left, and the difference in time for the same number of vibrations should correspond. The difference in the time for the same number of vibrations shows weak directive force.

The time is marked to the nearest

fractional part of a second required by the compass card to make ten complete vibrations across its starting point. In counting the vibrations it must be observed that the time is marked at the first passing of the reckoning point on the card, at the next count "one" at the next "two" and so on to "ten." Mark the time at "ten." The interval of time between "mark" and "ten" will be the time by the needle to make ten vibrations. For example, if it takes 11 seconds for the card to make 10 complete vibrations to the right, it should also take 11 seconds to make 10 vibrations with a swing to the left. If not it shows weak directive force.

The amplitude of arc by which the needle is drawn aside should be as small as possible consistent with accurately noting the tenth vibration across the zero, or starting point, which should allow the needle to pass two or three divisions beyond, in order to be sharply defined. The same amplitude should be used for each set of vibrations.

QUESTIONS FOR MASTERS AND MATES.—NO. 13.

190. What kind of liquid in a Baker compass?
191. What is the system of reading the compass by degrees?
192. What is the meridian of the compass? Why?
193. How does NE by E derive its name?
194. Your compass course is NE with the wind north, and you are making $\frac{1}{4}$ -pt. leeway. What course should you steer to counteract the effects of the leeway?
195. Owing to stress of weather you are forced to run into the wind and sea. Your course by compass is WNW, and you have run on this course for 16 hours, making 7 miles per hour; the Var. at start is $2\frac{1}{2}^\circ$ Ely. and at end 5° Ely. and the Dev. for WNW is $\frac{3}{8}$ -pt. Ely. what is the true course you have made good and how would you find your position on the chart?
196. You have an old chart dated 1898, which gives the Var. at a certain place as being $3^\circ 15'$ Wly, and the annual change is $5'$, what is the Var. for 1906?
197. Heading on Frying Pan and Pipe Islands range your compass says $N\frac{5}{8}E$, how much and which way is the deviation?
198. When a patent log indicates more miles than the ship has run, what might be the trouble with it?
199. What influences affect the log mostly?
200. With a following sea will your

log underrate or will it overrate?

201. You are steering SW, Var. 6° Wly when north star bears due north by same compass, how much and which way is the deviation?

202. The circumference of the earth at the equator is, in round numbers, 25,000 statute miles. The earth "turns" this off in 24 hours. The parallel of 60 degrees is just one-half of the circle of the equator. At what rate of speed does the earth turn on the parallel of 60 degrees? Why should it not turn as rapidly as on the equator?

203. Does the sun rise and set north or south of true east and west this season of the year?

204. If it were possible for an observer to be situated directly over the true north pole in mid-summer, what would be the true bearing of the sun at any time?

QUESTIONS FOR WHEELSMEN AND WATCHMEN.—NO. 14.

Give all shoals and principal landmarks passed on either hand. In taking courses to make good the magnetic course you should take the mean variation from point of departure to destination.

142. If heading on Grassy island ranges, Detroit river, your steering compass read N $\frac{3}{4}$ E, what would be the compass course from Lake Huron lightship to a point 4 miles E of Sand Beach main light with same compass and in same trim?

143. If heading on South Grosse Isle channel ranges, Detroit river, your steering compass read N $\frac{1}{2}$ W $\frac{3}{4}$ W, what would be the compass course from a point 4 miles E of Sand Beach main light to a point 4 miles E of Thunder Bay island light, with same compass and in same trim?

144. Having stern of boat on Neebish Isle ranges, Sault river, compass heading NW $\frac{1}{2}$ N, what would be the compass course from a point 4 miles E of Thunder Bay island light to Frying Pan and Pipe island ranges, with same compass and in same trim?

145. If heading on Neebish island ranges, Sault river, your compass read SE $\frac{1}{4}$ S, what would be the compass course from a point 2 miles SE $\frac{1}{4}$ S of Detour light to a point 4 miles E of Thunder Bay island light with same compass and same trim.

146. If stern of vessel was on South Grosse isle channel ranges, Detroit river, compass heading S $\frac{1}{2}$ E $\frac{3}{4}$ E, what would be the compass course from a point 4 miles E of Thunder Bay island light to a point 4 miles E of Sand Beach main light, with same compass and same trim?

147. Having stern of vessel on Har-

wood Pt. ranges heading on Dark Hole ranges, Sault river, your steering compass reads S, what would be the compass course from a point 4 miles E of Sand Beach main light to Lake Huron lightship, with same compass and same trim?

148. If heading on Amherstburg ranges, Detroit river, your steering compass reads N $\frac{1}{2}$ E $\frac{1}{4}$ E, what would be the compass course from Lake Huron lightship to a point 3 miles W $\frac{1}{2}$ N of Cove island light with same compass and same trim?

149. If stern of boat is on Amherstburg ranges, Detroit river, heading S $\frac{1}{2}$ W $\frac{3}{4}$ W, what would be the compass course from a point 3 miles W $\frac{1}{2}$ N of Cove island light with same compass and same trim?

150. Where are the Harlem, Corsica and Northwest shoals?

QUESTIONS FOR OILERS AND WATERTENDERS.—NO. 10.

91. Is it wrong for a feed pipe to enter the bottom part of a boiler, and why?

92. In what way are safety valves sometimes found defective?

93. Which is the best way to run an escape pipe from a safety valve?

94. Name an advantage if escape pipes were dispensed with.

95. What causes the seams of a boiler to leak?

96. What causes boiler plates to fracture?

97. What is meant by a circulating feed pipe?

98. What detects, if any, have they?

99. Allowing 15 per cent slip, what will be the progression of a steamer per hour with a propeller having 15 ft. pitch turning 70 revolutions per minute?

100. The steam pipe is 6 in. in diameter, and runs inside the boiler, the part inside has slots 3 in. long and $\frac{1}{4}$ in. wide. How many of these slots must there be to make an area equal to double the sectional area of pipe, and what are openings placed in this pipe for?

CONDITION OF STATE OF OHIO.

The passenger steamer State of Ohio is still on the rocks at Rattlesnake island, heavy weather preventing the wreckers from working. Her condition, however, is not as bad as the newspapers have represented. Capt. Cyrus H. Sinclair, representative of the underwriters, left the steamer with two companions in a small boat in a heavy sea to go to the Beebe House at Put-in-Bay for provisions. About midway over the boat was capsized. They were nearly spent when a tug put out from Middle

Bass and rescued them. Capt. Thomas Johnston, assistant to the president of the Great Lakes Towing Co., and Capt. Philip Broderick, local manager, reached the wrecked steamer on Tuesday morning on the tug T. C. Lutz, with the intention of having the wrecker Favorite and the Lutz pull on her should the conditions be favorable. It has continued too rough, however, to do any work.

BARGE PASADENA WRECKED.

The barge Pasadena was dashed to pieces just outside the shelter of the Lake Superior ship canal at the base of Keweenaw Point on Monday, the crew managing to reach shore after a desperate struggle. Two members of the crew were, however, drowned. The Pasadena was in tow of the steamer Gladstone. Just as the entrance to the ship canal was reached the tow line parted. The Gladstone made the entrance to the canal, but the Pasadena was kept up by the waves and dashed against the rocky shore. Her cargo of coal was insured by Pickands, Mather & Co. The Pasadena was 250 ft. keel, and 40 ft. beam and was built in 1885. Both vessels were owned by M. A. Bradley, of Cleveland.

DEATH OF JAMES H. DALLIBA.

James H. Dalliba, for a third of a century a prominent figure in the iron ore industry of the great lakes, died Oct. 8, in New York city, aged about 55. Some few years ago he was stricken with locomotor ataxia and retired from active business, removing to New York where he resided at the time of his death. Mr. Dalliba's first connections in the ore industry were with the Cleveland Iron Mining Co., now a part of the Cleveland-Cliffs Iron Co., in the early 70's, when he was located at the mines at Marquette, Mich. About 26 years ago he removed to Cleveland, forming a partnership with C. F. Stewart, and a few years later became a member of the firm of Dalliba, Corrigan & Co. After a few years in this connection, he joined the force of Pickands, Mather & Co., Cleveland, leaving it in turn to go with the Lackawanna Iron & Steel Co. Some ten years ago he returned to Pickands, Mather & Co., in which firm he became a partner and continued in this connection until ill health forced him to abandon business duties about two years ago. For a time after his removal from Cleveland he continued as New York consulting representative of the firm. He was a man of splendid character and his business associates are lavish in their praise of his many good qualities.

SAULT STE. MARIE CANAL COMMERCE.

The commerce of the Sault Ste. Marie canal for September was 7,250,159 tons, as against 7,343,727 tons in August, and 7,732,771 tons in July, thus maintaining practically a mid-summer clip. The movement to Oct. 1, of the present year has been 37,204,437 net tons, as against 31,947,743 tons for the corresponding period last year, and 20,089,632 tons for the same period during 1904. Following is the statement to Oct. 1, of the present year, with corresponding data for the two previous years:

MOVEMENT OF PRINCIPAL ITEMS OF FREIGHT TO AND FROM LAKE SUPERIOR.

Items	To Oct. 1, 1906.	To Oct. 1, 1905.	To Oct. 1, 1904.
Coal, anthracite, net tons.....	661,873	662,804	638,459
Coal, bituminous, net tons.....	5,482,914	4,196,459	3,208,389
Iron ore, net tons.....	26,485,982	23,788,994	12,394,797
Wheat, bushels.....	38,344,415	21,407,022	20,394,837
Flour, barrels.....	3,267,269	2,831,279	2,189,546

REPORT OF FREIGHT AND PASSENGER TRAFFIC TO AND FROM LAKE SUPERIOR, FROM OPENING OF NAVIGATION TO OCT. 1 OF EACH YEAR FOR THREE YEARS PAST.

EAST BOUND.

Items	To Oct. 1, 1906.	To Oct. 1, 1905.	To Oct. 1, 1904.
Copper, net tons.....	77,045	75,378	65,533
Grain, other than wheat, bushels.....	31,865,148	17,320,263	12,094,233
Building stone, net tons.....	4,472	7,963	19,116
Flour, barrels.....	3,958,005	2,831,279	2,189,559
Iron ore, net tons.....	26,485,982	23,788,994	12,394,797
Iron, pig, net tons.....	17,486	45,346	24,282
Lumber, M. ft. B. M.....	670,683	687,044	624,014
Silver ore, net tons.....			1,313
Wheat, bushels.....	38,344,415	21,407,022	20,394,837
Unclassified freight, net tons.....	120,841	73,333	63,744
Passengers, number.....	29,576	23,915	17,091

WEST BOUND.

Items	To Oct. 1, 1906.	To Oct. 1, 1905.	To Oct. 1, 1904.
Coal, anthracite, net tons.....	661,873	662,804	638,459
Coal, bituminous, net tons.....	5,482,914	4,196,459	3,208,389
Flour, barrels.....	9,264	7,175	287
Grain, bushels.....	6,749	1,533	1,625
Manufactured iron, net tons.....	246,580	96,855	111,574
Salt, barrels.....	297,789	317,780	281,959
Unclassified freight, net tons.....	696,855	498,121	372,828
Passengers, number.....	29,830	26,656	16,871

SUMMARY OF TOTAL FREIGHT MOVEMENT IN TONS.

	To Oct. 1, 1906.	To Oct. 1, 1905.	To Oct. 1, 1904.
East bound freight of all kinds, net tons.....	30,009,562	26,445,515	14,716,540
West bound freight of all kinds, net tons.....	7,134,875	5,502,228	5,373,092
Total freight, net tons.....	37,204,437	31,947,743	20,089,632

Total number of vessel passages to Oct. 1, 1906, was 16,603, and the registered tonnage, 29,723,337.

CUTTING OFF SHIP'S NOSE.

Estimates have been called for by the navy department for cutting off a section of the protected cruiser Detroit, now out of commission and tied up at the Boston yard, and preparing the ship for passage through the Canadian canal. The plan which the officers are now figuring on contemplates cutting off about 16 ft. from the ship's nose, and sheathing over the end thus left open in order to prevent the water entering. The section to be removed will be taken on board the ship when she is towed up the New England coast, down the St. Lawrence river, and through the canal.

Her destination probably will be Detroit, and upon her arrival there the severed section will be again set in place and the ship will be made whole once more. The Detroit will not be able to proceed under her own steam, and it will be necessary to tow her around. While the estimates have not been completed, it is roughly figured that the job will cost about \$10,000. Besides the work, it is also possible that the Boston yard will be called upon to expend about \$30,000 in fitting out the cruiser for the use of the Michigan naval militia. The Detroit

States and Latin America," in the course of which article he says:

"It is estimated that not one per cent of North Americans who travel abroad include South America in their itinerary, while not more than twenty per cent of Latin Americans traveling abroad seek the United States in their voyaging. Although more of them come to us, except in the case of Mexico, than we send to them, interchange of travel is so small as to have little beneficial effect. There are several reasons for this condition, among which is our lack of steamship facilities.

"On this point, indeed, too much cannot be said, not only because it is very important, but because it can and should be immediately changed. The advantage is now entirely with Europe and the disadvantage is wholly with the United States. This is not in any sense an argument for or against so-called 'ship subsidies,' but a plain, square statement of fact. At the present time there is not one first-class, fast, up-to-date express passenger or mail steamer running between any North American port and the ports of the great nations of South America. In contrast to this is to be noted the remarkable fact that Europe has nine different lines of large, commodious, modern, fast steamers giving frequent and excellent service between its chief ports and those of Latin America. Many of these boats will rival those of the northern trans-Atlantic lines in the luxury of their accommodations.

"It is true that there seems to be an abundance of freight steamers between the United States and South America, but no South American—and the number of those who travel is increasing annually—will take a freight, cattle or small steamer for the United States, when he has the selection of many lines of passenger, express and fast steamers to all ports of Europe; if he is a merchant or any kind of importer, he will naturally make his purchases there.

"Today everybody appreciates the vast importance of mail connections and their bearing on trade development. The merchant, or any person in Brazil, Argentina, Uruguay, Paraguay and Chili, who writes a letter to Europe requiring a reply, can get an answer in two-thirds the time needed in average communications with the United States. With such a situation as to travel and mails staring them in the face, it is high time that North American business interests did something to remove this heavy handicap."

The steamer T. S. Christie has been purchased by the H. H. Hetler Lumber Co. from George Engelking, of Chicago.

THE UNITED STATES AND LATIN AMERICA.

In the September *North American Review*, Hon. John Marrett, United States minister to Colombia, writes most interestingly on the subject of the "United

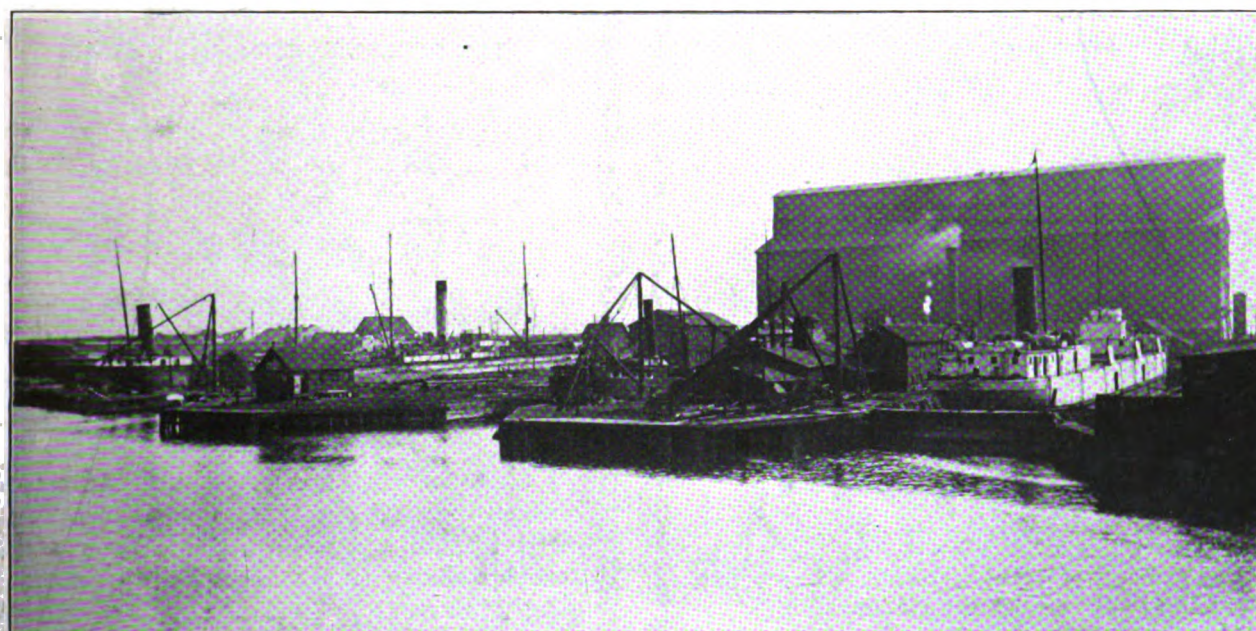
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Vol. XXXIV.

CLEVELAND, OCTOBER 11, 1906.

No. 15.



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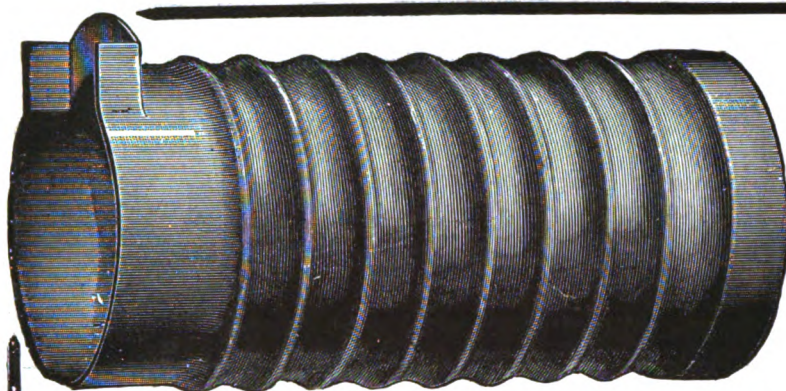
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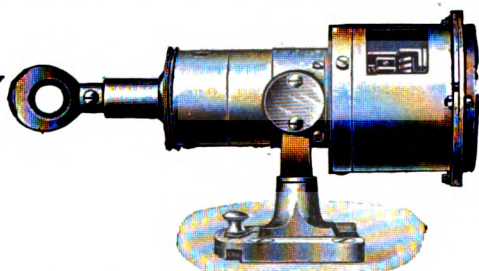
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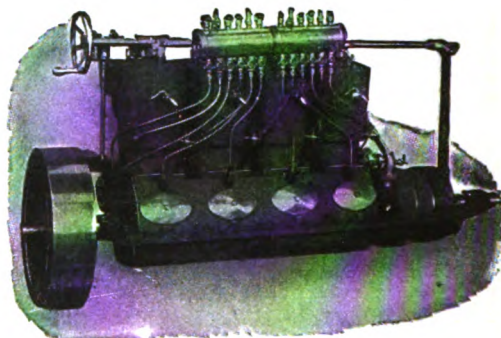
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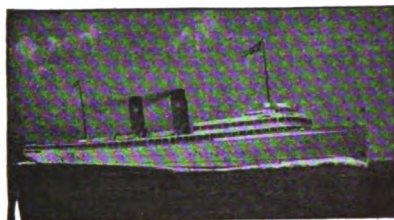
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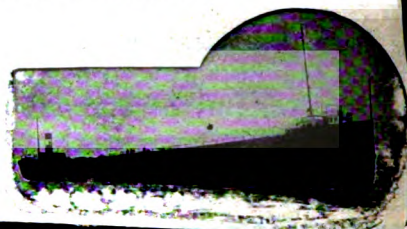
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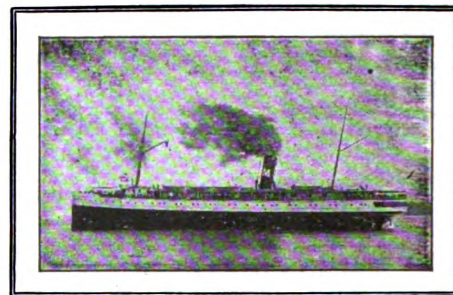
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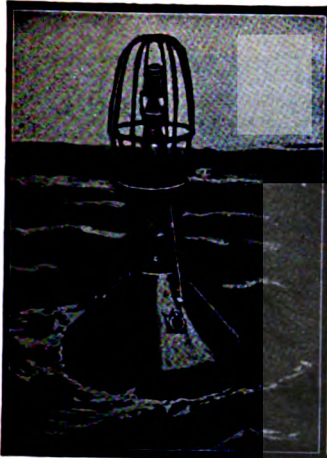
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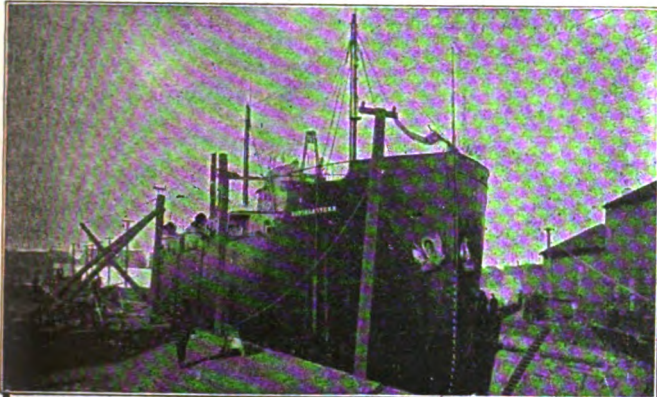
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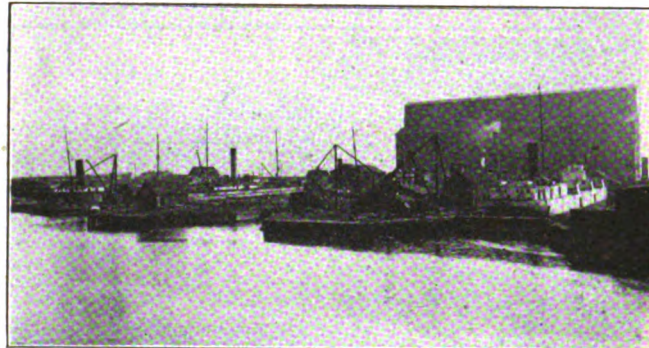
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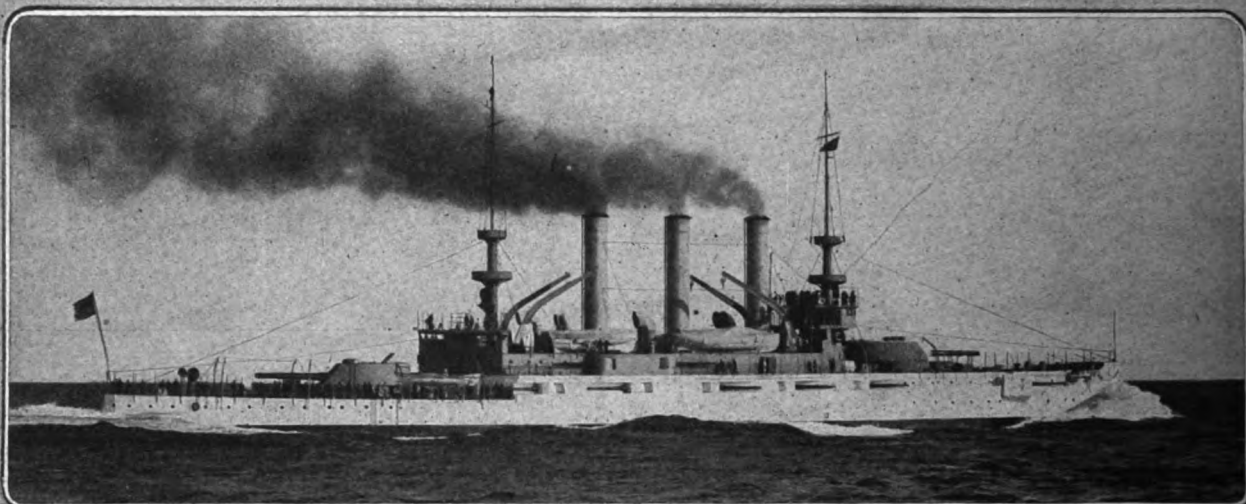
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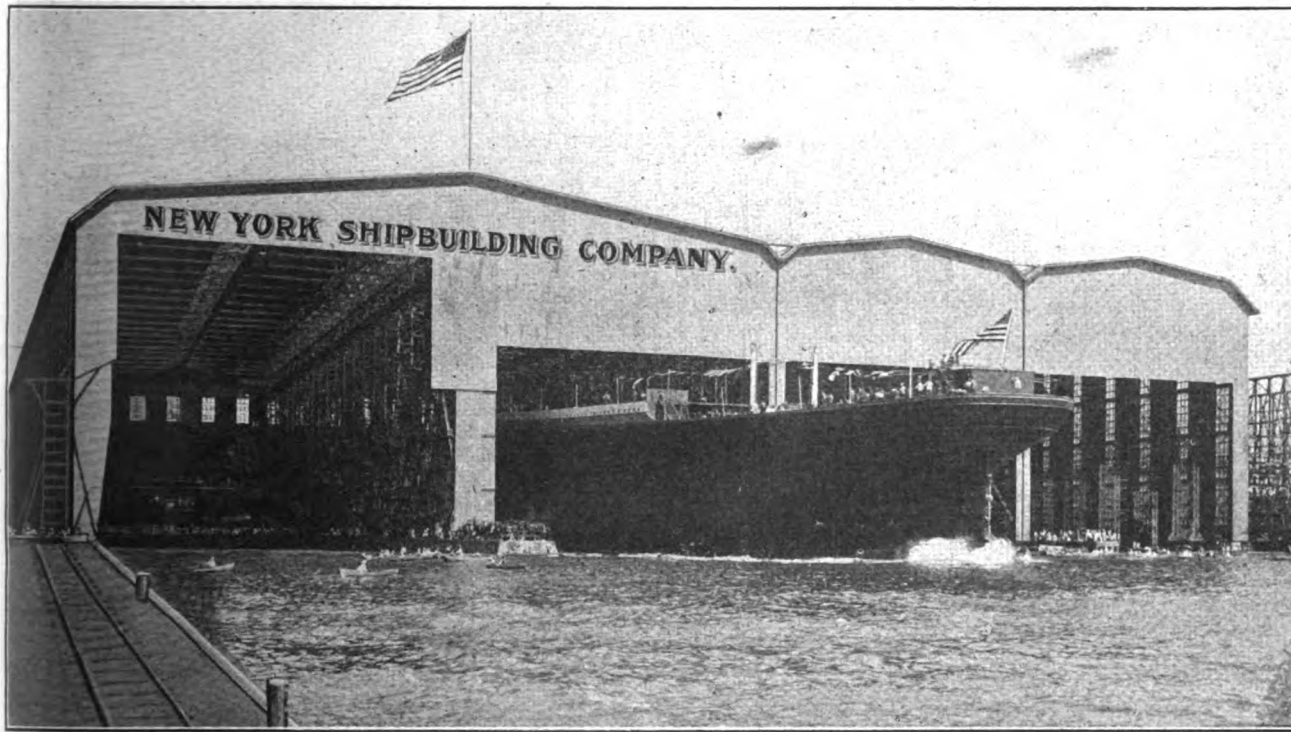
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CONTENTS

Introduction	Compass Error by Azimuths
Variation	Longitude by Chronometer (or Time) Sight
Deviation	Remarks on Longitude
How to find the Deviation	Longitude by Sunrise and Sunset
Leeway	Sights
The Log	Chronometer Sight of a Star
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The Nautical Almanac	Latitude by Meridian Altitude of Star
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Latitude by Meridian Altitude of a Star	Latitude by Ex-Meridian Altitudes
Latitude by Meridian Altitude of a Planet	Latitude by the Polestar
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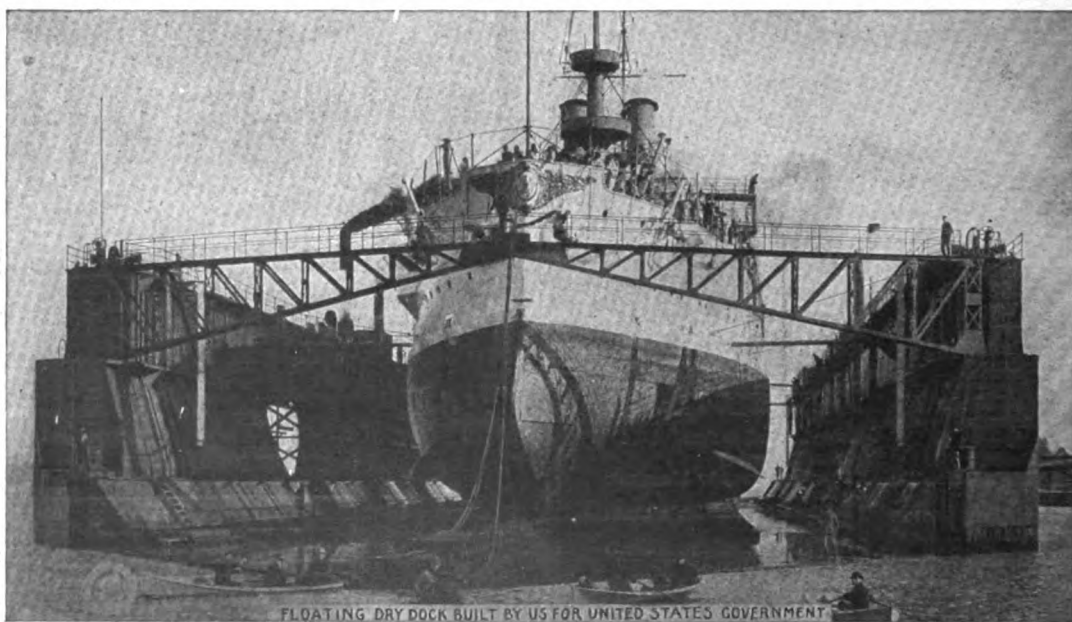
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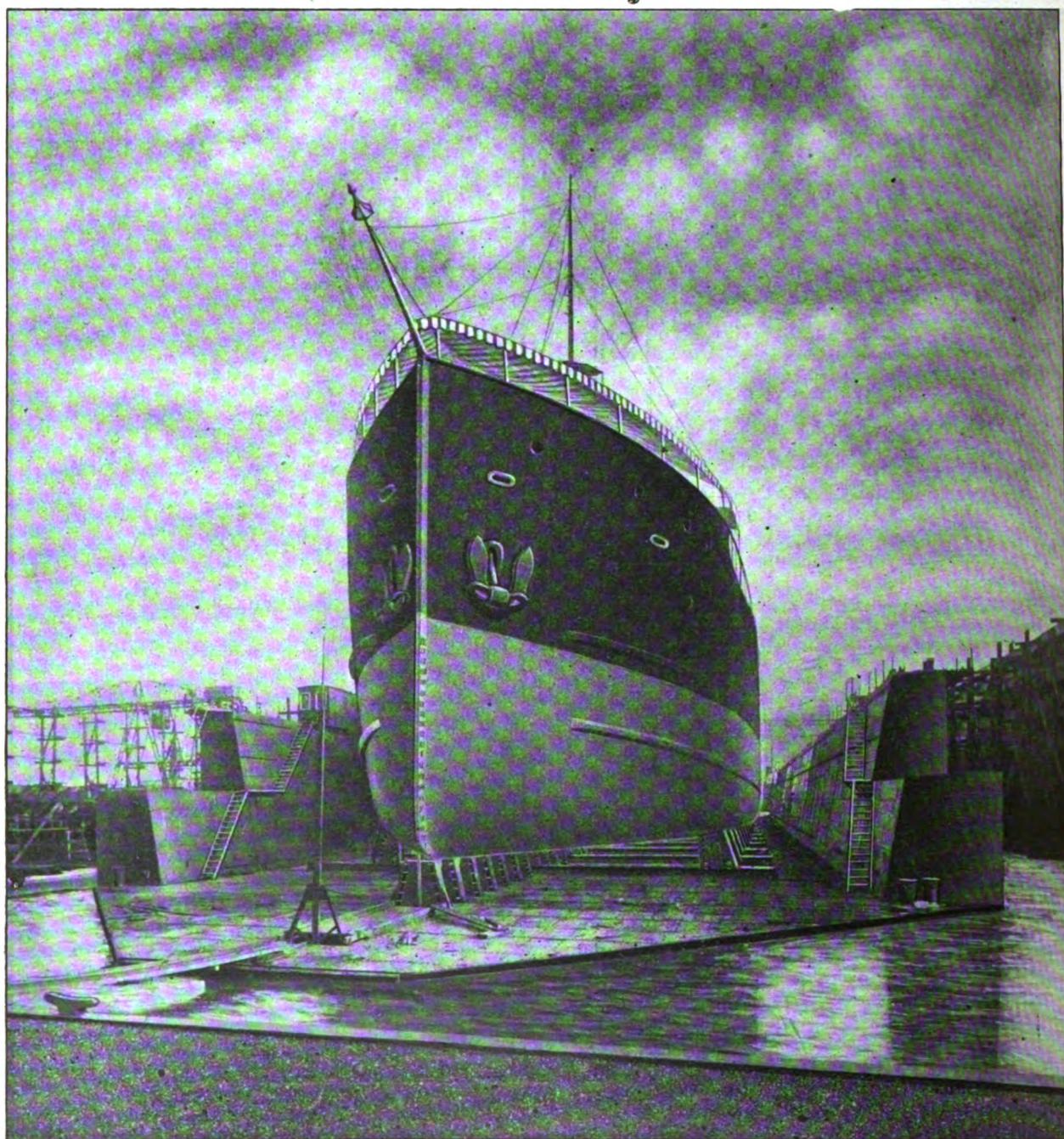
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Vice President.

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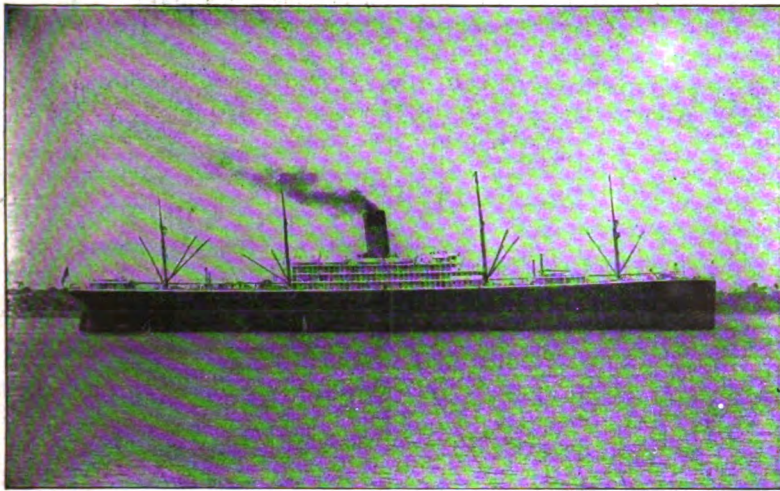


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Steamship Minnesota equipped with Hyde Windlass and Capstans.

Selected for the Minnesota and Dakota of the Great Northern Steamship Co.'s fleet—the largest vessels ever built in the United States. They are also being installed on nearly all of the vessels now building for the Navy Department, Revenue Cutter service, Lighthouse Board and the United States Coast Survey.

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BOURNE-FULLER CO.**

IRON STEEL

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Atlantic Mutual Insurance Company

Atlantic Building, 51 Wall Street, New York

Insures against marine and inland transportation risk and will issue policies making loss payable in Europe and Oriental countries.

Chartered by the State of New York in 1842, was preceded by a stock company of a similar name. The latter company was liquidated and part of its capital, to the extent of \$100,000, was used, with consent of the stockholders, by the Atlantic Mutual Insurance Company and repaid, with a bonus and interest, at the expiration of two years.

During its existence the company has insured property to the value of	\$21,108,343,494.00
Received premiums thereon to the extent of	224,197,211.06
Paid losses during that period	127,760,071.08
Issued certificates of profits to dealers	81,310,840.00
Of which there have been redeemed	73,744,440.00
Leaving outstanding at present time	7,566,400.00
Interest paid on certificates amounts to	19,469,981.85
On Dec. 31, 1905, the assets of the company amounted to	12,716,427.62

The profits of the company revert to the assured and are divided annually upon the premiums terminated during the year, thereby reducing the cost of insurance.

For such dividends, certificates are issued subject to dividends of interest until ordered to be redeemed, in accordance with the charter.

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G. STANTON FLOYD-JONES, Secretary.

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PROPOSALS.

U. S. Engineer Office, Jones Building, Detroit, Mich., October 2, 1906, Sealed proposals for hire of dredging plant for use in St. Mary's River, Michigan, will be received at this office until 2 p. m., Oct. 22, 1906, and then publicly opened. Information furnished on application. Chas. E. L. B. Davis, Col., Engrs.

SEALED PROPOSALS will be received at the office of the Light House Board, Washington, D. C., until 12 o'clock A. M., November 3rd, 1906, and then opened, for the construction and delivery of one single-screw steel steam light house tender and one twin-screw steel steam light house tender for the 11th Light House District.

FOR SALE.

Steamer T. S. Christie.

Length 160 ft.; beam 30 ft.; carrying capacity, lumber 525,000 ft., coal 800 tons. Rating in Inland Lloyds Register, A1½*, valuation \$22,000. For price and particulars address Capt. P. Larsen, Box 249, Chicago, Ill.

For Sale, Tug Gladiator.

Length, 115 ft.; breadth, 22 ft.; depth, 12 ft. Steeple compound engine 22 x 42 x 30. Housed in forward. Tug can be seen under working conditions at Duluth, Minn., by applying to Split Rock Lumber Co., Duluth, Minn.

For Sale.

1,000 h. p. fore and aft Neafie & Levy compound Engine; surface condenser; independent pumps.

Two 12-foot Scotch Boilers.

One 13½-foot Scotch Boiler.

One 10 16-25 x 16 triple expansion Engine.

Three 150-h. p. Almy Boilers.

One 200-h. p. Tregurtha Boiler.

One 14 30 x 24 fore and aft Engine and condenser.

One Williamson steering Engine.

One 10 k. w. electric lighting Set.

One 15 k. w. electric lighting Set.

One Providence Windlass, 50 fathoms 1½ in. chain.

Two thrust Shafts and Bearings, 8½ in. diameter.

MARVIN BRIGGS,

17 Battery place, New York, N. Y.

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The lighthouse steamer Haze, 145 ft. long, 27-ft. beam, 9-ft. draught, 500 tons capacity, 300 horsepower engine and boiler, suitable for passenger or freight business, fully equipped. Steam capstan, donkey boiler. Jacob Ullman, 46 Lloyd street, Buffalo, N. Y.

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Five Scotch Boilers, allowed 160 lbs. steam. Good as new. ERIE MA. CHINERY CO., 729 Garfield Bldg., Cleveland, O.

NOTICE.

The metallic life boat, life raft, and wooden boat building business of Thomas Drein & Son of Wilmington, Del., is still being conducted by his estate. The old workmen have all been retained, and the same high grade of work is guaranteed.

Will Sell Cheap.

One large Queen City steam steering gear, complete; one large steam windlass, cylinders 9 x 9, made by Bath Iron Works; two very heavy iron timber heads. Outfit originally cost \$2,700; will sell for \$600. Address 8381 Detroit Ave., W. D. Metcalf, Cleveland.

THAT'S OUR BUSINESS

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CHICAGO STEAMER EXCHANGE,

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PLANS AND SPECIFICATIONS FURNISHED.

GREAT LAKES REGISTER SURVEYORS ARE ESTABLISHED AT ALL THE PRINCIPAL PORTS ON THE GREAT LAKES.

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320-322 Perry-Payne Building, CLEVELAND, O.

IN THE EXCHEQUER COURT OF CANADA, TORONTO ADMIRALTY DISTRICT

Martin Mahony vs. The Ship "City of New York."

Under and by virtue of a Commission of Sale issued out of the above named Court, the ship "City of New York" will be sold by public auction subject to reserve bid, on board of said Ship at Loughheed's dock in the Town of Sarnia, Ontario, on Saturday the 13th day of October, 1906, at the hour of 12 o'clock noon. Provided however, that if the highest bid be less than the reserved bid, it may be accepted subject to the approval of the Court.

"The City of New York" is a Screw Steamer built in Cleveland, Ohio. Length 136 feet; Main-breadth 27.6, and has one High Pressure engine. Gross tonnage 292.00; Registered tonnage 198.56.

For further particulars apply to

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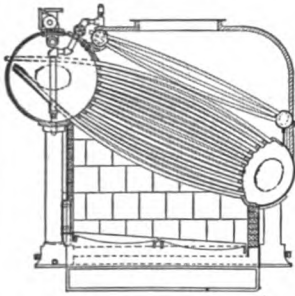
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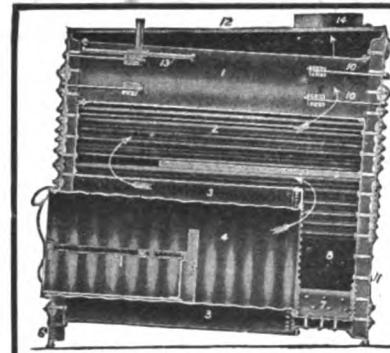
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Simplest, lightest most compact boiler made. Most accessible for cleaning and repair. Five vertical rows or as many as 45 tubes may be cleaned or withdrawn by removing the cover from a single hand hole. Largest grate surface on a given floor space. No joints in the fire. All joints expanded. Greater steam room and water capacity than any other boiler. Built in sizes up to 2000 H. P. Mosher Boilers have been supplied for eleven torpedo boats and the monitor Florida of the U. S. Navy, amounting to over 28,000 H. P., six torpedo boats for the Russian Navy two gun boats for the Mexican government, one cruiser and one

torpedo boat for the Brazilian government; the steam yachts Arrow, Elide, Feiseen, Wauneta, Presto, and numerous other yachts and vessels.

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Internally Fired.

Scotch and Water Tube types combined, eliminating all objections.

Half the weight of ordinary Scotch boilers.

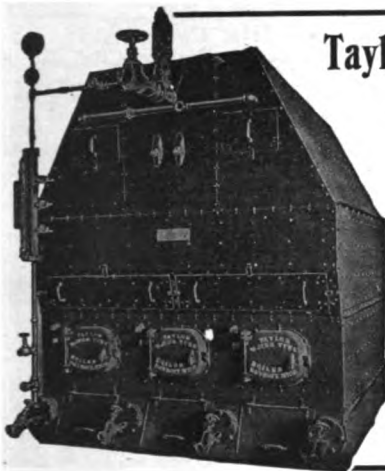
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Patent applied for.

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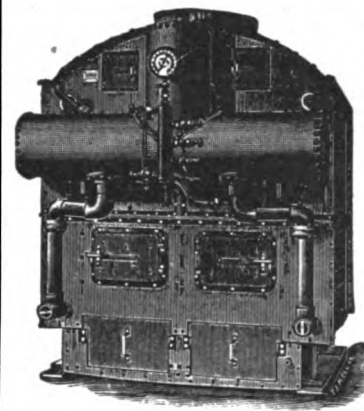
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Vertical Tubes, sectional, large steam space and liberating area.

Fire box, combustion chamber, and course for the furnace gases similar to the Scotch Marine. Free circulation type.

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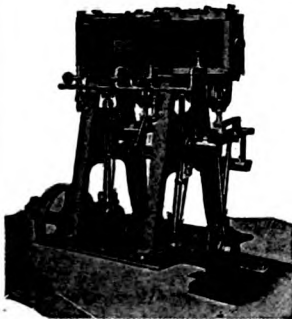
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PROVIDENCE, R I

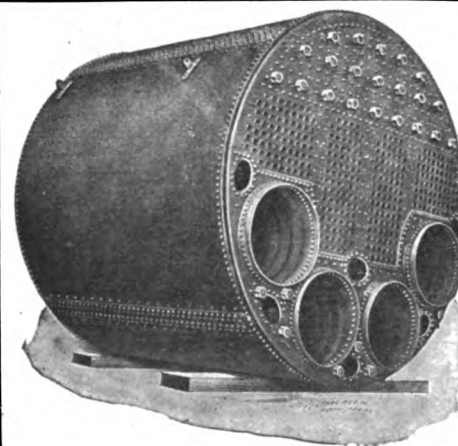
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Boyer Sectional Water Tube boilers and machinery complete for light draft Passenger Boats, Yachts, Tugs, Etc.

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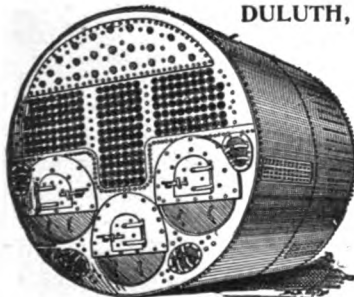
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FOUNDRY &
MACHINE
WORKS,**

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Northwestern Steam Boiler & Mfg. Co.

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**BOILERS, ENGINES
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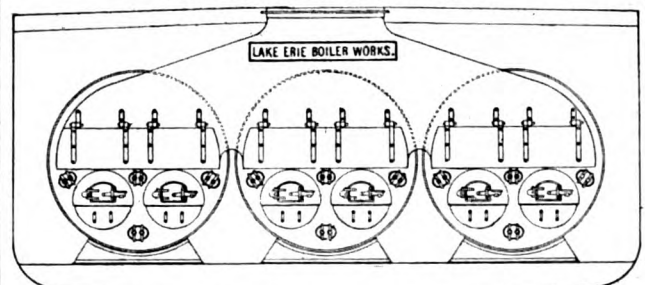
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[See accompanying Index of Advertisers for full addresses of concerns in this Directory.]

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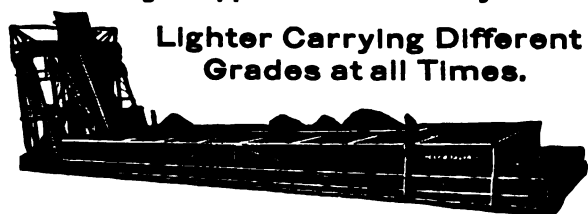
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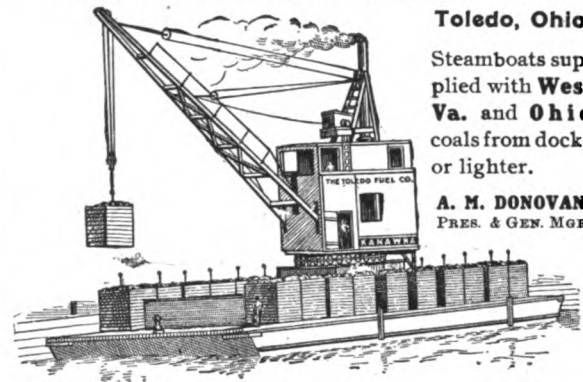
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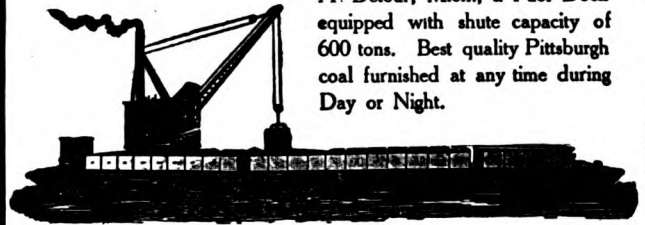
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See Wrecking Companies.

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Lake Ontario
St. Lawrence River Nos. 1, 2, 3 4, 5, 6
Coast-Charts Nos. 1, 2, 3, 4, 5
Oswego Harbor
Little Sodus Bay
Great Sodus Bay
Charlotte Harbor
Niagara Falls

LAKE ERIE

Lake Erie
Coast-Charts Nos. 1, 2, 3, 4, 5, 6, 7
Detroit River
Lake St. Clair
St. Clair River
Buffalo Harbor and Niagara River
Dunkirk Harbor
Erie Harbor and Presque Isle
Conneaut Harbor
Ashtabula Harbor
Fairport Harbor
Cleveland Harbor
Lorain Harbor
Huron Harbor
Sandusky Bay
Maumee Bay and Maumee River

LAKE HURON

Lake Huron and Georgian Bay
South End of Lake Huron
Saginaw Bay
Straits of Mackinac
Coast-Charts Nos. 5, 6, 7, 8
Sand Beach Harbor of Refuge
Saginaw River
Tawas Harbor
Thunder Bay
Presque Isle and Middle Island
St. Marys River Nos. 1, 2, 3
St. Joseph Channel and Western End of North Channel

LAKE MICHIGAN

Lake Michigan
North End of Lake Michigan

South End of Lake Michigan
Beaver Island Group
Grand and Little Traverse Bays
Coast-Charts Nos. 1, 2, 3, 4, 5, 6, 7, 8, 9
South End of Green Bay
North End of Green Bay
Manistique Harbor
Charlevoix Harbor
South Fox Island Shoals
Manitou Passage
Frankfort Harbor
Manistee Harbor
Ludington Harbor
Muskegon Harbor
Harbor at Michigan City
Lake Front, Chicago
Milwaukee Harbor
Sheboygan Harbor
Manitowoc Harbor
Sturgeon Bay, Canal, and Harbor of Keluge
Head of Green Bay
Little Bay de Noc
Portage Lake, Manistee Co.

LAKE SUPERIOR

Lake Superior
Lake Superior Nos. 1, 2, 3
Coast-Charts Nos. 1, 6
Coast-Chart No. 8, including Isle Royal
Grand Island
Marquette and Presque Isle Harbors
Huron Bay and Huron Islands
L'Anse and Keweenaw Bay
Portage Lake and River
Copper Harbor
Agate Harbor
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Eagle River
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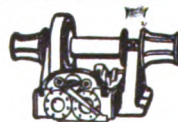
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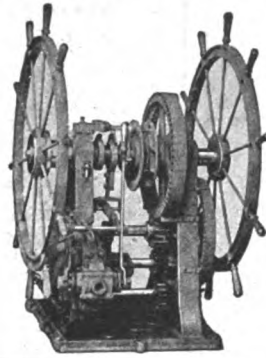
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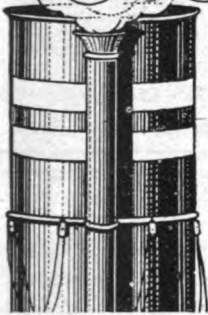


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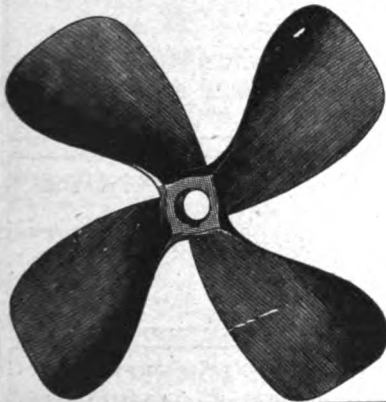
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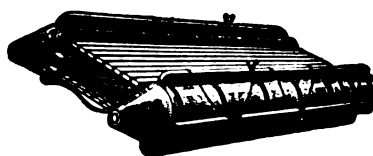
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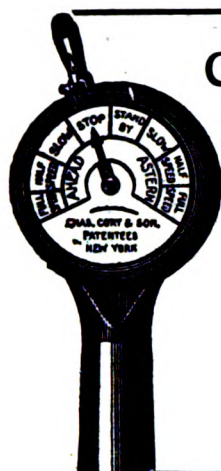
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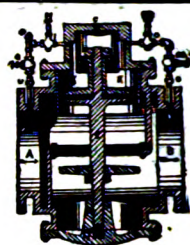
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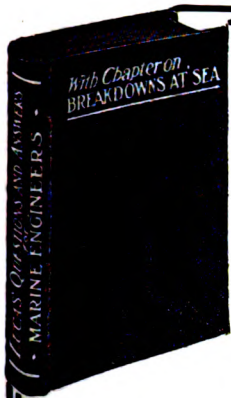
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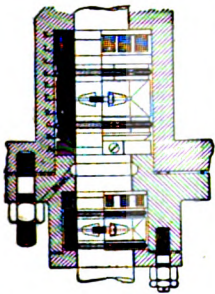
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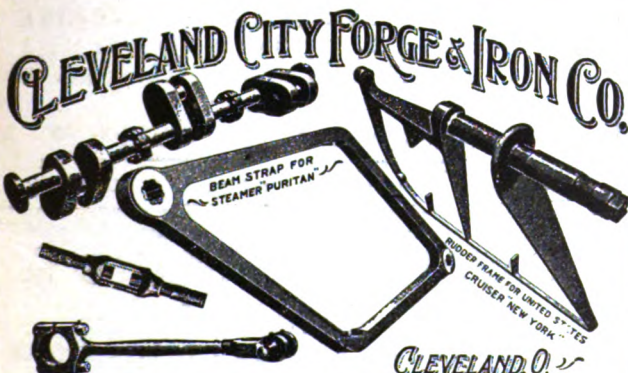
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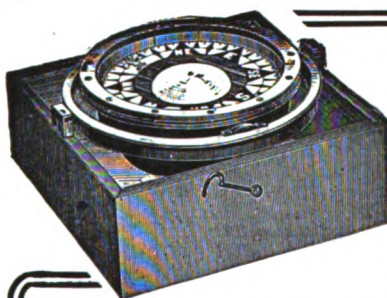


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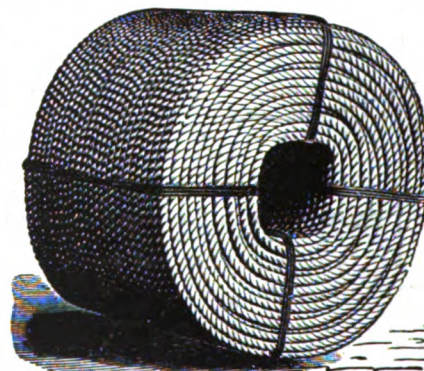
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